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THE SPANISH INQUISITION AS AN ALIENIST.

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THE degree of responsibility attaching to insane criminals has in all ages been a difficult problem for the dispenser of justice. I am not aware that the contributions made to its elucidation by the Spanish Inquisition have ever received attention, and the history of a few cases which throw light upon this phase of the subject may not be without interest.*

On September 20, 1621, Madrid was startled by the report of a shocking sacrilege committed in the chapel of the archiepiscopal prison. A vagrant Catalan, named Benito Ferrer, had been arrested as an impostor for begging in clerical garments without being in orders. The offense was not serious, and after a month's detention he was about to be discharged, when, at the morning mass, as the bell tinkled to announce the elevation of the Host, Benito, who was praying with a rosary in an upper chamber, rushed down like a madman to the chapel, seized the Host, which had been deposited on the communion cloth, broke it, flung the fragments on the floor and trampled on them, exclaiming, "O traitor God of darkness, now you shall pay me!" He was promptly seized and carried to the courtyard, where he was stripped of his cassock, and when some fragments which had lodged in it fell to the ground he endeavored to stamp on them with similar ejaculations. The first care of those present was to gather reverently the pieces of the body of the Lord; the soles of Benito's shoes were carefully scraped, and the dust and sand

* I am indebted to the custodians of the Königliche Bibliothek of the University of Halle for the opportunity of consulting the records of these cases.

of the courtyard were swept up into a white cloth. He was chained hand and foot, maintaining a sullen silence and refusing to answer questions.

The affair, of course, excited the utmost horror. The young king, Philip IV, then only five months on the throne, sent his favorite, Count Olivares, to ascertain for him the facts, and the papal nuncio eagerly sought the details to report them to Rome. The archiepiscopal vicar, Diego Vela, was at first disposed to take a rationalistic view of the matter: he asserted the insanity of his prisoner, and proposed to discharge him, doubtless thinking it wiser to assume that no Spaniard in his senses could be capable of an offence so heinous. He was soon, however, made to understand that this would not be allowed, and it came near bringing him into trouble. The Holy Office asserted its jurisdiction over a case of heresy so flagrant; on the 23d Vela surrendered Benito to the Supreme Council of the Inquisition, and he was sent to the tribunal of Toledo (for as yet there was none in Madrid), with orders that his trial should be pushed with all expedition—an urgency that was soon after twice repeated, with the significant addition that the king took special interest in the matter and desired to know its progress.

The Toledan inquisitors were prompt and zealous. The dilatory and cumbersome forms of procedure were hurried as rapidly as the traditions of the tribunal would permit, and in exactly two months, on November 23d, they were ready to pronounce sentence. Yet the end was still far off. In his examinations Benito had been made to give the details of his life. He was forty-three years old, born at Camprodon of an Old Christian father and a mother who had Jewish blood in her veins—a fact which told heavily against him. His father, who was a cloth-shearer, took him, at the age of thirteen, to Montserrat and placed him with an uncle, a chaplain in the monastery, who in six months sent him back to his father in Barcelona. For some time he served as page to persons of quality, and finally Don Bernardo Terres took him to Flanders, when the Cardinal Archduke, Albert of Austria, went thither in 1595. There he had a succession of masters, with one of whom he returned through France to Catalonia. Filled with desire for a religious life, in 1603 he entered the Barefooted Carmelite convent of Mataron as a novice, but was expelled in about six months. After vainly seeking to join the Carthusians of Monte Alegre and the Jeronymites of Murta, at last the Observantine Franciscans of Barcelona gave him the habit, but deprived him of it in about eight months. Then two years were spent in study at Tarragona, which he left in 1606, and since then he had led a wandering life in pious pilgrimages. He had offered his devotions at the shrine of his

namesake, San Vicente Ferrer, at Vannes; twice he had been to Rome and once to Monte Cassino and Sicily, besides traversing Spain and Portugal in all directions. About 1609 came the shadow which darkened his subsequent life. Fray Francisco de la Virgen, the master of the novices at Mataron, was Antichrist, and had bewitched him, since when all men whom he met were demons. He had ceased to attend mass or to confess and take communion, for he could find no priest who was not a demon. When, in the upper room of the prison, he was praying and heard the bell that told of the elevation of the Host, it was revealed to him that the officiating priest was a demon and the Host was another. In doing what he did he performed a service to God, and he would repeat it fifty millions of times if the occasion required. This Carmelite Antichrist, moreover, had in 1606 killed Philip III and his three children, and their places had since then been filled by demons. There was also some wild talk about Toledo being no longer Toledo, nor Madrid Madrid, for Saint Joseph had changed them all. Barcelona is now La Imperial de Santa Ana, and is on the Straits of Gibraltar, for Catalonia has grown so that it is now larger than all Spain was formerly. The emperor of La Imperial is Don Dalman de Queralt, who daily sends him food in prison, so that he has not to accept it from the demon alcaide and his attendants. The inquisitors have no power to burn him, for they are all demons and he is in the hands of God. With all this he was strictly orthodox in his replies to the searching questions of the inquisitors as to his belief in transubstantiation and other points, except that he attributed five persons to the Godhead—Michael and Gabriel being added to the Trinity. Throughout the course of his prolonged trial nothing could make him swerve from these hallucinations or modify his story. He defied the inquisitors, for he had a revelation in prison that they were demons and had no power to harm him.

Anxious as were the inquisitors to push the trial to a conclusion, they felt that evidence of his sanity was necessary. For this they examined the alcaide of the prison and his assistant and three fellow-prisoners confined in the same cell. All testified to Benito's soundness of mind as evinced in his daily actions, though he was silent and reserved and spent most of his time in prayer or in reading his breviary. Then three physicians were made to visit him several times, who reported that he talked sanely on most subjects but wildly on others; the insanity seemed feigned, and according to the rules of the medical art he was sane. Thus fortified, on November 23d, the inquisitors called together the regular *consulta*, an assembly of experts, to decide on the case. There were nine of them in all—the three inquisitors, the Vicar General as representative of the Archbishop of Toledo, and five

consultores or assessors. Opinions were not harmonious. Four voted to put Benito to the torture to verify his sanity, and if this failed then to make inquiry into his antecedents, Three voted to relax him to the secular arm for burning, first employing learned theologians to convince him of his heresy. Two were in favor of the common-sense plan of endeavoring to ascertain his sanity without torturing him.

When, in the customary routine, these diverse views were submitted to the Inquisitor General and Supreme Council, that body considered the case maturely. Statements of the leading points involved were laid before three skilled theologians, two of whom pronounced Benito to be a sacrilegious heretic whose delusions were feigned. The third opined that he might be subject to demoniacal possession, for which he should be exorcised and subsequently tortured to ascertain the truth. On January 12, 1622, the Council sent these *calificaciones* or opinions to Toledo, with instructions to get similar ones from learned men there; also, to examine more carefully into Benito's sanity and to investigate the causes of his expulsion from the convents which he had sought to enter. Accordingly, on January 15th, the Toledo tribunal assembled four Dominican masters of theology, who unanimously pronounced Benito a heretic and an impostor. To ascertain details about an insignificant novice who some twenty years before had passed a few months in a convent might seem impossible, but the perfected organization of the Inquisition was equal to it. The tribunals of Barcelona and Valencia were called upon; the *frailes* who had been novices in Benito's time were hunted up in the convents to which they had scattered, and four were found who entertained some recollection of him. Three of these described him as mentally deficient, and one of these remembered his having revelations; the fourth spoke of him as "melancholy" and like one possessed by the devil.

May was drawing to an end when the result of these investigations reached Toledo, and the summer was spent in fresh examinations of those in the prison who had access to Benito, and in getting opinions from theologians and physicians. That he showed signs of insanity was evident, but the experts held that the proof of soundness of mind was infallible and the madness feigned. So when, on September 10th, another *consulta* was held, the vote to burn him was unanimous—the two assessors who had previously advocated simple investigation having been discreetly omitted from the meeting. On this decision being submitted to the Supreme Council, it met with no greater acceptance than the former one, and it was sent back September 17th, with orders to torture Benito to ascertain his intention in the sacrilege and the fiction of his insanity.

In the proceedings of the Inquisition torture was so universal a resource in cases of doubt, that its use for the diagnosis of insanity need not be a matter of surprise. On October 13th it was duly applied. Benito was brought in and told that if he would not confess the truth he would be tortured, to which he replied quietly and earnestly that he had told the truth and was not mad; he had acted only as a faithful Christian and at the command of the Eternal Father. In the administration of torture the nerve of the patient was tested at every step with adjurations to tell the truth and with promises of mercy—lying promises, for confession would only secure the boon of being garroted before burning. So in this case, at the making out of the sentence of torture, its formal signing, the adjournment to the torture chamber, the stripping of the prisoner, the tying him to the *banquillo* or trestle, the adjusting of the *cordeles* or sharp cords around each thigh and each upper arm—at every stage he was entreated affectionately (*con mucho amor*) to tell the truth and save his soul. Benito's resolution was immovable; to every adjuration his reply was the same —he had told the truth, and the inquisitors were demons. Then the torture began, scientifically graduated, and at every interval came the adjuration and the response. First a single cord around each member, successively tightened and twisted into the flesh, then another and another, until there were six on each limb and the blood was dripping from them all—in spite of the universal rule that torture was never to be carried so far as to cause effusion of blood. The official report of the examination minutely records his shrieks and groans and writhings, his fruitless prayer for water, his despairing appeals to Jesus, Mary, and Joseph, his cries that he is dying, and through it all his unvarying response that he had told the truth and that the inquisitors were demons—an assertion which he once offered to prove if they would give him a Bible. When the capacity of the *cordeles* to inflict increased torment was exhausted he was threatened with the rack, but to no purpose. It was made ready and he was stretched on it, but this augmentation of agony was fruitless. His resolution was unconquerable, and at last his wearied judges ordered him to be untied, still threatening him with a continuation of the infliction if he would not tell the truth. Exhausted nature could do no more; with a final ejaculation that he had told the truth, for they were demons, he sank motionless and remained silent.

For three unbroken hours the torture had lasted, and the inquisitors said that it was too late for more that day, so they suspended it, warning him that they were not satisfied, and that it would be resumed if he did not tell the truth. He was carried back to his cell, and two days later was brought before the tribunal again. Even in the pitiless secular criminal legislation of the

period the endurance of torture without confession was held to purge away the evidence against the accused and to entitle him to an acquittal, but it was otherwise in the Inquisition. The torture had been merely to gratify the curiosity of the judges and to justify the foregone conclusion of his burning. Therefore, when they now examined him and adjured him to tell the truth, and he answered by referring to his previous statements as the truth, they had him carried back to his cell, and coolly assembled their *consultores* to pronounce on him a second sentence of relaxation to the secular arm for burning. This was duly submitted to the Supreme Council, which postponed its answer until November 24th. Then it said that it held him to be insufficiently tortured, but that for the present he should be kept in prison and carefully watched to determine his sanity. He was to be confined with persons who could be relied upon and sworn to secrecy, who should observe him and report.

Another cell was accordingly selected for him, in which were two friars and a physician awaiting trial, who were duly sworn and instructed. So matters continued for a year, with occasional examinations of his fellow-prisoners. The friars pronounced him a heretic and an impostor; the physician a sane man subject to delusions. Finally, in November, 1623, another consultation was held to vote upon his case, and he was unanimously sentenced to burning. To this at last the Supreme Council assented, but desired the execution to take place in Madrid, where the sacrilege had been committed. He was to be sedulously kept in ignorance, and to be secretly conveyed to the capital. There, on the *Plaza Mayor*, January 21, 1624, there was a solemn *auto da fé* celebrated, and he was burned alive as an *impenitente negativo*.

If this was expected to strike salutary terror into the hearts of sacrilegious heretics and to instill respect for the Venerable Sacrament, it signally failed of its purpose. In less than six months, on Friday, July 5, 1624, Madrid was again thrown into excitement by a double sacrilege that had every appearance of organized premeditation. During the celebration of morning mass in the church of San Felipe, a man named René Perrault, who was kneeling near the altar, suddenly leaped forward at the elevation of the Host, and crying out, "Why do you elevate this idol of Christ, so that the people commit idolatry and offend God?" he snatched it from the hand of the priest and scattered it in fragments on the floor, while with a sweep of his arm he overturned the cup that was standing on the altar. At the same moment a similar scene was enacted at the church of Santa Barbara, by a man named Gabriel de Guevara. It was with difficulty that the offenders were rescued from the summary venge-

ance of the worshipers, and they were forthwith brought before the Inquisitor General, Andrés Pacheco. Apparently his experience of the Toledo Inquisition in the previous affair had not been satisfactory, for he at once himself undertook the preliminaries of the case, and hastily organized for its trial in Madrid a tribunal which sat in extemporized quarters in the convent of the Barefooted Carmelites. The documents concerning Guevara are not accessible, but those of the trial of Perrault present to us another aspect of the dealings of the Inquisition with insanity.

Friday was busily occupied with the examination of witnesses, and at 10 P. M. Perrault was brought before the inquisitor. He was still defiant, and told his story without hesitation or concealment. He was about forty years old, born at Angers, of Catholic parents. Brought up in strict orthodoxy, he had, until within a fortnight, always been a good Catholic, regular in his attendance on confession, communion, and mass. For twelve years he had wandered around Spain as a peddler of needles, thimbles, and such small wares, till a fortnight before at Talavera, while in the street seeking customers, a sudden revelation from God showed him that there was only one God, the Creator; that Christ was an impostor, who had properly expiated on the cross the blasphemy of calling himself the Son of God, and that what the people adored was idolatry and an offence to the Almighty. From that time this idea was ever present to him, on the road and in the house. God impelled him to do what he had done, and to come to Madrid for the purpose, so that the act should be more conspicuous. He had left his saddle-bags at Getafé, a village a few leagues distant, on Tuesday, July 2d, and had come with his mule to Madrid. There he first looked up a French paper and fruit seller named Domingo Diaz, of whom he inquired the address of his brother, Pierre Perrault, an embroiderer living in Madrid. He found him, and told him of the revelation and his consequent intention, when Pierre earnestly reasoned with him, telling him that it was a suggestion of the devil, and that he would denounce him to the Inquisition if he were not his brother. The next morning Pierre came to him with an Italian, a tailor; they bought some food, crossed the bridge of Toledo, breakfasted by the roadside, and René agreed to return to Getafé. After parting he traveled half a league on his mule; he chanced to overtake a man going thither, by whom he sent word to his host to forward his saddle-bags to Madrid, and he turned back to the city. To render his act more symbolical, he resolved to postpone it until Friday, so he had a day and a half on his hands. These he spent in seeing the sights of the capital, and he mentioned his disappointment on going to the theatre and finding there was no performance. On Friday morning, at breakfast, he abstained from his customary

flask of wine, in order that it might not be said that he was drunk. He went to San Felipe and committed the sacrilege.

The next day, when brought again before the tribunal, his enthusiasm had evaporated. Excitement had been followed by reaction; he realized the terrible fate in store for him, and was eager to avert it in any way he could. He had been drunk, he said, the day before, and had stumbled against the priest; he was crazy; people had given him food which rendered him insane, and the ill-treatment to which he had been exposed habitually on the road had driven him mad. At Consuegra he had been beaten; at Medellin, beaten, imprisoned, and his goods confiscated; he was a good Catholic, and believed all that the Church believed, and he remembered nothing of the confession of yesterday; or, if he had said such things, he must have been out of his senses. When, later in the day, his formal defense was drawn up and presented by his advocate, it was that he had been drunk, and he now supplicated mercy and penance.

Probably no trial before the Inquisition, since the abounding harvest of its early days, was ever conducted so speedily. Though all the formalities were observed, on Sunday, July 7th, the consultation was held to determine the sentence. The opinion was unanimous that he should be relaxed to the secular arm for burning, but on the question of preliminary torture a difference arose. The Inquisition was naturally desirous to know whether he had accomplices; the simultaneous crime of Gabriel de Guevara pointed to concerted action; besides, one of the witnesses had testified that René entered San Felipe with two men clad in the French fashion, who departed at the commencement of the mass. René had consistently denied this, asserting his independence of action and sole responsibility; but heretic plots were always floating before the inquisitorial imagination, and it was manifestly impolitic to burn René without utilizing him for the conviction of his possible confederates. While, therefore, all the consulters agreed that he should be subjected to unlimited torture, some held that it should be *in caput alienum*, to discover his associates; while others, in view of his varying confessions, humanely urged that it should be employed for the benefit of his soul, and to confirm him in the faith. The next day the Supreme Council, in approving the sentence, decided that the torture should be *in caput alienum*.

At ten o'clock that night René was brought before his judges and questioned as to accomplices, but he only repeated his story, with a few additional details. In the torture which followed he manifested a curious mingling of strength and weakness. Before it commenced he flung himself on his knees and begged piteously for mercy, but refused to forfeit his soul by perjury, for he had

no associates, and no Frenchmen entered San Felipe with him. During all the stages of graduated torment he screamed and struggled desperately, but he adhered resolutely to this, and refused to incriminate any one; he had never breathed his intention to any save his brother, who threatened to denounce him to the Inquisition. This continued till half past one o'clock, when the inquisitors, finding the torture fruitless, announced its discontinuance; but next morning they commenced proceedings against Pierre Perrault and Domingo Diaz. What was the result of these we do not know; but had anything been extracted from them further compromising René, it would have appeared in the records of his trial.

If the torture thus was useless *in caput alienum*, it at all events served the more humane purpose of confirming the sufferer in the faith. On July 12th word was brought to the inquisitor Chacon that René desired to return to the Church: he hastened to the temporary prison where the culprit was confined and found this to be the case. Now that he had nothing further to hope, René said that his first statement was true. He had been misled and tempted by Satan for fifteen days before the crime, and had believed that he was rendering a service to God; but now God had enlightened him, and he reverted to his former belief in the Trinity, in the passion of Christ, and the transubstantiation of the sacrament, and he desired to be reconciled to the Church.

On the following Sunday, July 14th, Madrid enjoyed the religious spectacle of an *auto da fé*, in which René Perrault was burned, but doubtless his recantation obtained for him the privilege of being garroted before the pile was lighted. Thus, if Spain furnished to Geneva the Unitarian Miguel Servet, France returned the favor with René Perrault.

Another case, less tragic in its issue, illustrates a different phase of the subject. At Cobeña, a village not far from Alcalá de Henares, a poor carpenter of plows named Benito Peñas, or de Valdepeñas, created scandal by denying that Christ had died on the cross. He was wholly illiterate but devout, and once, when visiting Madrid with a load of corn, he had heard in the church of San Felipe a sermon by a *fraile*, who spoke of the passion and resurrection as metaphorical.* The idea took possession of his

* The Spanish preachers of the period allowed themselves the largest license in the effort to attract attention, and shrank from no grotesqueness of irreverence. In the trial in 1592, of Fray Joseph de Sigüenza, a distinguished Jeronymite friar and favorite of Philip II, there is a description of a sermon preached before the king by Fray Cristóbal de Lafra, another Jeronymite, on the feast of the Nativity of the Virgin. He said the Minotaur was Christ and the Labyrinth the gospel *liber generationis;* Ariadne was Our Lady, and the child she bore to Theseus was Faith; and that if any one desired to enter the Labyrinth

brain and played havoc with the anthropomorphic conceptions of orthodox theology, including the humanity of Christ. This had been going on for several years, when early in 1640 the attention of the archiepiscopal visitor, Bernardo Garcia de San Pedro, was called to it on his reaching Cobeña. He promptly threw Benito into the village jail, where many priests and friars visited him and labored fruitlessly to convince him of his error. Then, in July, Dr. Buendia, the physician of Cobeña, denounced him to the nearest commissioner of the Inquisition, Juan Burgalez Diaz, at Fuente el Saz. The affair was now fully in train. Diaz hastened to Cobeña, took testimony of some of the chief inhabitants, and forwarded the papers to the tribunal of Toledo. The inquisitors submitted to *calificadores* the propositions contained in the reports of Benito's talk, and they were duly condemned as heretical and Manichæan. The Inquisition, however, appears to have thought little of the matter, and it would probably have gone no further, had not a zealous cleric of Cobeña, toward the end of the year, written that the people were scandalized at the delay in acting in an affair so notorious. Thus stimulated, on January 25, 1641, the inquisitors issued an order to bring Benito to Toledo, and to sequestrate his property—the latter being the customary precaution for the event of a sentence of confiscation.

It was the invariable practice of the Inquisition, whenever possible, to make the accused, whether innocent or guilty, pay all the expenses attending his trial. The familiar to whom the order was sent was therefore required, in sequestrating Benito's property and placing it in the hands of a receiver, to keep thirty ducats for expenses; if there was no money or grain, then he was to sell at auction enough to realize this amount, and he was also to reserve a bed and bring it with him for Benito's use in prison. These customary instructions were rigidly carried out as far as practicable. A reversionary interest in some money left by a dead brother was garnisheed, and security taken to await the result of the trial. The only ready money in Benito's possession amounted to nineteen copper coins or *cuartos*, worth in all about two reales and a half; so on Sunday, February 10th, his pitiful store of furniture, tools, and clothing was sold by auction in the public square after high mass, reserving only the garments on his back and one of two old shirts for him to wear; even the rosary in his hands

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he must pray to the Virgin for her child. He also said that God was the heifer Io, who converted Jews; that wherever God trod he left his footprints, which are his works; asking who made these admirable works of the sun, the moon, etc., the answer, Yo Yo, gave the name, which is God—the name impressed by the steps of the heifer. It is therefore by no means improbable that Benito Peñas may have heard a sermon which conveyed to him the impression he described and led to his misfortunes.

was taken and sold. The total proceeds amounted only to two hundred and forty and a half reales, or less than twenty-two ducats, and, after deducting costs, the commissioner handed over to the familiar twenty ducats. The expenses of guards and the journey to Toledo consumed more than half of this; and when Benito was delivered on February 16th at the *carceles secretas*, there were but one hundred and five and a half reales left, which were duly entered on the prison books. The timid suggestion of the familiar of some remuneration for his time was left unnoticed.

When on February 18th Benito was examined, he willingly repeated all the articles of the creed except "suffered under Pontius Pilate, was crucified, dead, and buried, and on the third day arose from the dead," which he obstinately refused to utter. It was easy to entangle him in a theological discussion in which he was led to deny the incarnation and conception by virtue of the Holy Ghost, the birth and death, and the second advent. The efforts made to convince him of his error of course only hardened him in his belief, and he resolutely accepted the inferences drawn from it until he came virtually to deny the Trinity—the three names were but three different designations for the one God. He was ready, he declared, to die in defense of his belief, and all the theologians in France and Spain could not convert him. When the counsel assigned to him by the Inquisition found him immovable, he formally withdrew from the defense in order not to incur the penalties decreed against advocates who undertook to defend heretics.

In March the inquisitors began to entertain doubts as to Benito's sanity, and sent to Cobeña to obtain testimony respecting it. The evidence was emphatic as to his soundness of mind. The *cura* had known him for forty years, and had never entertained a doubt of it; the alcalde and others who knew him said the same. It was true that for a year or more prior to his arrest he had grown very devout, praying much and frequenting the church; moreover, on one occasion he had remained shut up in his house for some days, until the alcalde and *cura* broke in and found him lying with a rosary in his hand in a trance, from which they aroused him with a rope's end, and he had repeated this in a hermitage near the town, but in all the relations of life he had shown himself in full posession of his faculties.

Thus the case went on with the deliberation customary in the Inquisition, until in July it was resolved to make a more thorough investigation as to his sanity. Two learned theologians were deputed to examine him, who reported him to be crazy: his answers bore no relation to the questions put to him; he talked of the omnipotent God and the sweet name of Jesus; the Virgin was created without father and mother, and was anterior to Eve; when

we die our bodies are not converted into dust; in fine, he was not a case for the Inquisition, but for a madhouse. Then two more theologians were called in, and their opinions were the same. Evidently under the paternal care of the Inquisition his insanity was developing rapidly.

In August the three physicians of the Holy Office were summoned to examine him. Two of them questioned and cross-questioned him, and were prepared to pronounce him sane when the third arrived, and in the course of examination chanced to ask him what signs he had of his own salvation, to which he replied that when he commended himself to God he saw lights like stars descend from heaven to him. This convinced them, and they reported that he was insane or was subject to diabolic illusions. The alcaide of the prison and his assistant were then interrogated; they had no doubt of his insanity from his disordered talk and from the fact that they always found him kneeling in prayer. Then as a last effort two more distinguished theologians were deputed to convince him of his errors, but they found their labors hopeless, and declared that he was crazy.

It was impossible to resist this cumulative evidence, and when, on August 29th, the customary consultation was held to decide upon his fate, the opinion was unanimous that he was irresponsible. It was agreed to write to the authorities of Cobeña to that effect; his relatives must send for him and take care of him; he was never to be allowed to leave the town, and must henceforth wear a doublet half gray and half green. To this the response was that he had no kindred, but Juan de San Pedro was sent to bring him home, while a plaintive allusion to the expense of the journey and the absence of all property from which to defray it received no attention.

Thus the poor wretch was beggared, deprived of all means of livelihood, and condemned to the disgrace of exhibiting his shame in a party-colored garment at a time when such insignia had a peculiarly sinister significance. According to the convictions of the period, it was all for the greater glory of God; but as an alienist, the Inquisition was clearly not a success.

In his ascent of Mount Dulit in Borneo, 5,090 feet high, Mr. Charles Hose found a cave above four thousand feet, with wild tobacco growing at its mouth and several remarkable ferns, of one of which the fronds were fourteen feet long. The fauna illustrated the widespread distribution in the highlands of Borneo of Himalayan forms. A magnificent view was had from the moss-clad summit of the mountain of distant ranges. Some natives reported having heard a tiger roaring in the neighborhood, but Mr. Hose found that the sound proceeded from a gigantic toad, which measured fourteen inches and a half round the body.

FOSSIL FORESTS OF THE YELLOWSTONE.

By Prof. SAMUEL E. TILLMAN.

THE fossil forests of the Yellowstone Park are among its most interesting features, but they are as yet not within ready reach of the tourist, and so little has been published about them that only a few have definite knowledge of them. It is accordingly believed that the accompanying notes in regard to them will be of general interest.

The locality to which the term fossil forest has especial reference is along the west rim wall of the valley of the Lamar River,

Fig. 1.—Point of Specimen Ridge: *a*, *b*, *c*, Petrified Stumps.

or East Fork of the Yellowstone, opposite the mouth of Soda Butte Creek. The same arrangement of petrified stumps and trees is, however, found at many other places in this region separated by considerable distances—as much as thirty miles. The general physical conditions that brought about the existing state of affairs is so plainly shown by the present exposures that they can not be mistaken.

The petrifactions were visited at several places, but the description appended refers to a part of the ridge designated on the map of the Geological Survey as Specimen Ridge, at a point about six miles east of the junction of the Lamar and Yellowstone Rivers.

The fossil trees exposed at this point are along the upper slope of the southern wall of Lamar Valley. The slope here makes an angle of about thirty-three degrees with the horizon, and is about nine hundred feet long. The petrifactions are standing all the way up this slope, interspersed with the living conifers of to-day, represented at Fig. 1. At first sight it appears that either these ancient trees grew upon the slope now exposed, and that there had been no change in the slope from that day to this, or that the present had brought back *exactly the same surface conditions* as existed when the now silicified trees were alive. Such an apparently simple conclusion would, however, involve more remarkable phenomena than are yielded by the true explanation.

A little consideration, taken in connection with the formation of the bluffs that connect Lamar Valley with the higher lands to

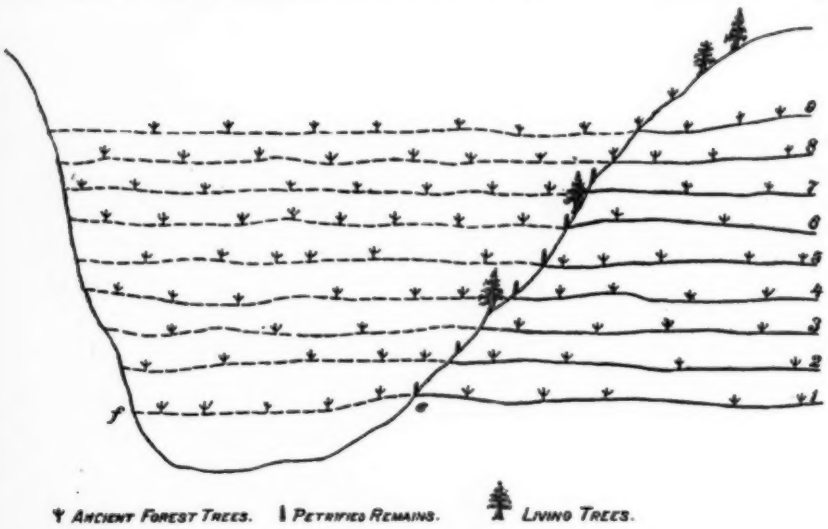

Fig. 2.

the south and west, shows clearly the action that has placed the living and petrified trees upon the same slope at this and at many other points in the region.

A series of forests has grown upon successive levels, each level having been produced by an accumulation of volcanic material which destroyed the then existing forest. This explanation will be readily understood from Fig. 2. The level upon which the first forest grew is indicated by 1. The level of the volcanic accumulation which destroyed this growth of trees is shown at 2. Upon this second level came another growth of trees, which in turn was destroyed by the accumulation extending to the level 3. Still another forest grew upon 3, which in course of time was destroyed. This alternate growth and destruction was repeated

until at this place (Specimen Ridge) there grew and were destroyed certainly *nine* successive forests and very probably twelve. This is all indicated in Fig. 2.

The number of growths was determined in two ways: first, where the roots of the petrified trees are shown at different heights in the same vertical plane the horizons of growth may be counted directly; second, when the roots do not show, a sufficient vertical distance must be allowed between horizons to insure that the projecting body at one level does not have its roots in the horizon next below.

In the second method it was sometimes possible to settle the point by following the volcanic ledges to the right or left until a petrifaction with roots exposed, decided the question.

In later times, when the volcanic accumulations had ceased and the agents of denudation began their work, the layers of lava and the great sheets of volcanic conglomerate were gradually eaten away, and a valley formed extending in the figure from *e* to *f*. Along the southern slope of this valley are growing the conifers of to-day, and on the same slope also stand the petrified stumps, the relics of many successive forest growths. Thus, though the living and the petrified trees now stand on a common slope, the latter did not, like the former, all grow at the same time, but succeeded each other at intervals of considerable length.

These standing silicified stumps and fallen trees were found varying in diameter from one to seven feet. Two sections of trees were found so perfect that the rings of annual growth throughout could be counted, except a few, perhaps fifteen or twenty, near the heart and bark. One tree, measuring three feet in diameter, had two hundred and twenty-two rings of growth; and another, of three feet five inches diameter, had two hundred and forty-three—this without any allowance for a few missing rings at the center and toward the bark. The larger of these trees was only about half the size of the largest seen. Many were found varying in diameter from five to seven feet, but none of this size were seen exposing the rings throughout the entire section. Judging from the closeness of the rings in certain well-preserved portions of these larger trees, many of them must have been at least five hundred years in attaining their growth, if the rings were truly annual. Taking one half this number, two hundred and fifty years, as the more probable age of the successive forests at this point, it is seen that the earliest of these trees were living more than two thousand years before the latest, during which time there were alternating conditions of growth and accumulation of volcanic material.

This estimate makes no allowance for the time necessary for the formation of a soil upon the volcanic material, which at first

sight would seem necessary for the support of such a vigorous vegetation. It is not probable, however, that any considerable time was necessary for this purpose, for, with rare exceptions, each succeeding forest took root and began to grow very promptly after the destruction of its predecessor. In most cases the destroying flood consisted largely of mud, ashes, conglomerate, and other volcanic material, which formed an excellent base for vegetation, and it was doubtless covered with a luxuriant growth as soon as it was dried or cooled sufficiently, and this would require only a short time.

In some cases the trees grew upon a true lava base; but even then the growth began very promptly after the flow; for the upper surface of the lava soon weathered sufficiently for vegeta-

FIG. 3.—A, B, PETRIFIED STUMPS NEAR YANCEY'S, TWENTY MILES EAST OF THE MAMMOTH SPRINGS.

tion to gain a footing. The growing trees then too, as at present, were frequently supported by very shallow and wide-spreading roots. We now often see large trees with such roots standing over rocks barely covered with soil; the petrified trees exhibit the same phenomena.

Besides the standing stumps, the fossil forests contain many specimens lying upon the ground. Some of these were petrified standing and then fell, and others were down before the petrifying action began. It is frequently possible to distinguish between the two by position: the first lie upon the present slope of the ground; the second often show the original surface and consequently pro-

ject at different levels from the bluff and making angles with the present slope.

It is rather remarkable that only one standing stump was seen with a limb in position. This is probably explained by the fact that the living trees were generally covered by the volcanic material to a less height than that of their lowest limb, and consequently the upper portions of the trees were not preserved, but suffered aërial decomposition. In general, the silicified tree would crumble down as rapidly as the rock material surrounding it would wear away, so that only short stumps would now be found, though greater lengths were petrified. The absence of limbs in position is, however, mainly due to the fact first named. In the cases of trees that were petrified after they had fallen, both limbs and roots projecting upward were seen in position.

Specimens of rotten wood far progressed toward complete decomposition were found perfectly preserved in stone. Petrifactions of bark were of frequent occurrence, and the channeling and borings of worms or insects were beautifully preserved in some of the specimens, so that we literally have *petrified wormholes.*

In some of the finer water-collected *débris* were found beautifully preserved impressions of leaves, showing two kinds of deciduous trees, of course entirely different from any trees now growing in the region. The impressions of conifer leaves and the petrified part of the same wood were also found.

These fossil tree remains are found over a wide area in the park region. Along Soda Butte Creek they stand up the slope from each bank, but along the Lamar River, below the mouth of this creek, they exist on the left bank only, the imbedding material having been entirely removed from the right bank by erosion. The lowest level at which a petrified tree was seen in position was on the left bank of the Yellowstone, opposite the mouth of Hell-roaring Creek, at an approximate altitude of 6,100 feet. The highest was seen opposite the mouth of Soda Butte Creek at an altitude of about 8,180 feet. These trees are twelve or fifteen miles apart, and the original slope of the ground between them is not known, so that they can not be taken to fix the highest and lowest levels of the original forest growths in this area.

At Specimen Ridge, where the closest examination was made, the lowest stump seen in position was at an altitude of about 7,000 feet, and the highest a little over 7,500 feet. There were here between these limiting growths certainly nine successive forests, and of course an equal or greater number of incursions of imbedding materials.

In what has gone before I have not attempted to designate

definitely the imbedding material which ingulfed and destroyed the living trees, and in which the petrifactions are now preserved. It is, as a rule, a volcanic conglomerate, or more properly a volcanic agglomerate. Both the matrix and the imbedded particles are truly volcanic, the latter varying from dust particles through all sizes up to those of a ton or more in weight. That the material has been accumulated under the partial influence of water or liquid conditions is evident from the more or less perfect stratification which generally pervades it. But the fragments are too angular, brecciated, to have suffered transportation and deposition as subaqueous or as ordinary river deposits. The attractive and satisfactory explanation of conglomerate formation in the Utah plateau region, as given by Captain Dutton, I do not think is here applicable.

From what is said in regard to the series of forest growths, and also from the evident thinness of the layers of *débris*, it is seen that there have been many successive sheets of the material laid down at the same place. In some cases and at certain places a true lava flow has spread over the surface, but the lava ledges can at points be seen to shade into the brecciated layers. While not believing that the great mass of breccia, covering perhaps hundreds of square miles, has been literally ejected from volcanoes, as has been held in regard to such formations, I am of the opinion that the accumulation of it is the direct and immediate result of such eruption.

Extruded lava from any source, not being perfectly liquid, would cool with an irregular surface, and terminate in precipitous ledges. This unevenness of surface, combined with the original slope that must have existed to permit any flow, would soon cause the whole area involved to be abundantly floored with volcanic fragments of all sizes. During subsequent eruptions these fragments would be swept along by and with the liquid matter, commingled with dense showers of ejected material, amid heavy flows of water from accompanying rains and perhaps melting snows, to be deposited in layers at varying distances from the centers of eruption, the condition in which it is now found. Most of the material of which the agglomerate is composed I believe to have come by the ordinary process of weathering of previously erupted rocks, and then to have been commingled with finer ejected material and distributed by the floods which accompanied some if not all the outflows. The interstratified beds of varying degrees of fineness are the results of less tumultuous periods.

Such explanation involves the necessity for many centers of eruption in the park region, for the agglomerate is of wide extent, and it could not be formed at great distances from these centers.

The above facts and conclusions are from personal observations begun by me in the summer of 1891, and continued in the summer of 1892 in connection with Prof. James Mercur, of the United States Military Academy. Not until we had embodied our conclusions in an official report to the War Department did I become aware that anything had been published in relation to these forests. I then learned that Mr. W. H. Holmes, formerly of the Hayden Survey, had made reference to them in his report on The Geology of the Yellowstone Park; also that Mr. W. H. Weed, of the present Geological Survey, had contributed an article upon the subject to the School of Mines Quarterly for April, 1892. It is believed that nothing else of an explanatory or descriptive nature has been published in regard to these interesting objects.

PRIVATE RELIEF OF THE POOR.*

BY HERBERT SPENCER.

LESS objectionable than administration of poor relief by a law-established and coercive organization, is its administration by privately established and voluntary organizations—benevolent societies, mendicity societies, etc. "Less objectionable" I say, but still, objectionable: in some ways even more objectionable. For though the vitiating influences of coercion are now avoided the vitiating influences of proxy-distribution remain. If we have not a machinery so rigid as that set up by the Poor Law, yet we have a machinery. The beneficiary is not brought in direct relation with the benefactor, but in relation with an agent appointed by a number of benefactors. The transaction, instead of being one which advantageously cultivates the moral nature on both sides, excludes culture of the moral nature as much as is practicable, and introduces a number of bad motives. Note the ill workings of the system.

As with the Poor Law (especially the old Poor Law), those who were distressed but thrifty and well conducted got no help, while help came to the improvident and ill-conducted; so with philanthropic societies in general. The worthy suffer rather than ask assistance; while the worthless press for assistance and get it. The Mansion House Fund of 1885–'86, for instance, was proved to have gone largely for the support of "idlers, spendthrifts, and drunkards." "They did not see why they should not have some of the money going as well as their neighbors." In some cases applicants "*demanded* their share." Where, as in another case,

* From the author's Principles of Ethics, vol. ii, just published by D. Appleton & Co.

employment was offered, less than one fifth proved to be good for anything; showing that the unemployed, so generally pitied as ill-used by society, are unemployed because they either can not or will not work; and showing, by implication, that charitable agencies enable them to evade the harsh but salutary discipline of Nature.

The encouragement of hypocrisy, which goes along with this neglect of the good poor who do not complain and attention to the bad poor who do, becomes conspicuous when religious professions are found instrumental to obtainment of alms. Clergy and pious women, easily deluded by sanctimonious talk, favor those who are most skilled in utterance of spiritual experiences, and in benedictions after receiving gifts. Hence a penalty on sincerity and a premium on lying; with resulting demoralization.

This evil is intensified by sectarian competition. There are competing missions which collect and distribute money to push their respective creeds, and bribe by farthing breakfasts and penny dinners. Nearly half the revenue of one mission is distributed in credit tickets, and "if the recipient wishes to cash his ticket, he can not do so until after the evening service": this vicious system being carried even to the extent that the visitors try "to force its tickets on the most respectable and independent people"—pauperizing them to make hypocritical converts of them. Said one woman, poor but clean and tidy, who saw how the emissaries of the Church favored the good-for-nothings: "I didn't want any of the good lady's tickets . . . but it's very 'urtful to the feelings to see that careless drinking people living like 'ogs gets all, and them as struggles and strives may go without." And not only does there result a discouragement of virtue and an encouragement of vice, but there results a subsidizing of superstitions. Unless all the conflicting beliefs thus aided are right, which is impossible, there must be a propagation of untruth as well as a rewarding of insincerity.

Another evil is that easy-going people are *exploité* by cunning fellows who want to make places for themselves and get salaries. A crying need is found; prospectuses are widely distributed; canvassers press those on whom they call; and all because A, B, C, etc., who have failed in their careers, have discovered that they can get money by playing the parts of manager, secretary, and collector. Then, if the institution vehemently urged is established, it is worked in their interest. But it is not always established. As there are bubble mercantile companies, so there are bubble philanthropic societies—societies kept up for a time merely for the purpose of getting subscriptions. Nay, on good authority I learn that there are gangs of men who make it their business to float bogus charities solely to serve their private ends.

Not even now have we reached the end of the evils. There is the insincerity of those who furnish the funds distributed: flunkyism and the desire to display being often larger motives than beneficent feeling. These swindling promoters when writing to wealthy men for contributions, take care to request the honor of their names as vice-presidents. Even where the institutions are genuine, the giving of handsome subscriptions or donations, is largely prompted by the wish to figure before the world as generous, and as filling posts of distinction and authority. A still meaner motive co-operates. One of the *nouveaux riches*, or even one whose business is tolerably prosperous, takes an active part in getting up, or in carrying on, one of these societies supposed to be originated purely by benevolence, because he likes the prospect of sitting on a committee presided over by a peer, and perhaps side by side with the son of one. He and his wife and his daughters enjoy the thought of seeing his name annually thus associated in the list of officers; and they contemplate this result more than the benefits to be given.

There are kindred vitiations of other organizations having beneficent aims—orphanages, provisions for unfortunate and aged tradesmen, etc. Here again, the least necessitous, who have many friends, are usually those to benefit, and the most necessitous, who have no friends, are neglected. Then there is the costliness and corruption of the selecting process—expensive and laborious canvassing, exchange of votes, philanthropic log-rolling. Evidently the outlay for working the system, in money and effort, is such as would be equivalent to a maintenance for many more beneficiaries, were it not thus wasted in machinery.

Nor is it otherwise with institutions thought by most people to be indisputably beneficial—hospitals and dispensaries. The first significant fact is that thirty per cent of the people of London are frequenters of them; and the largeness of this proportion makes it clear that most of them, not to be ranked as indigent, are able to pay their doctors. *Gratis* medical relief tends to pauperize in more definite ways. The out-patients begin by getting physic and presently get food; and the system "leads them afterward openly to solicit pecuniary aid." This vitiating effect is proved by the fact that during the forty years from 1830 to 1869, the increase in the number of hospital patients has been five times greater than the increase of population; and as there has not been more disease, the implication is obvious. Moreover, the promise of advice for nothing attracts the mean-spirited to the extent that "the poor are now being gradually ousted out of the consulting room by well-to-do persons." People of several hundreds a year, even up to a thousand, apply as out-patients, going in disguise: twenty per cent of the out-patients in one large hospital having

"given false addresses" for the purpose of concealing their identity. Swarming as patients thus do, it results that each gets but little attention: a minute being the average for each, sometimes diminished to forty-five seconds. Thus those for whom the *gratis* advice is intended get but little. Often "the assistance given is merely nominal"; and "is both a deception on the public and a fraud upon the poor." These gratuitous medical benefits, such as they are, "are conferred chiefly by the members of the unpaid professional staffs" of these charities. Some of them prescribe at the rate of three hundred and eighteen patients in three hours and twenty minutes—a process sufficiently exhausting for men already hard-worked in their private practice, and sufficiently disheartening to men with little private practice, who thus give without payment aid which otherwise they would get payment for, very much needed by them. So that the six hundred thousand pounds a year of the metropolitan hospitals, which, if the annual value of the lands and buildings occupied were added would reach very nearly a million, has largely the effect of demoralizing the patients, taking medical care from those it was intended for and giving it to those for whom it was not, and obliging many impecunious doctors and surgeons to work hard for nothing.*

These various experiences, then, furnished by societies and institutions supported by voluntary gifts and subscriptions, unite to show that whatever benefits flow from them are accompanied by grave evils—evils sometimes greater than the benefits. They force on us the truth that, be it compulsory or non-compulsory, social *machinery* wastes power, and works other effects than those intended. In proportion as beneficence operates indirectly instead of directly, it fails in its end.

Alike in the foregoing sections and in the foregoing parts of this work, there has been implied the conclusion that the beneficence which takes the form of giving material aid to those in distress, has the best effects when individually exercised. If, like mercy, it "blesses him that gives and him that takes," it can do this in full measure only when the benefactor and beneficiary stand in direct relation. It is true, however, that individual beneficence often falls far short of the requirements, often runs into excesses, and is often wrongly directed. Let us look at its imperfections and corruptions.

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* The evidence here summarized will be found in Medical Charity: Its Abuses, and how to remedy them, by John Chapman, M. D. Some of the sums and numbers given should be greatly increased; for since 1874, when the work was published, much hospital extension has taken place.

The most familiar of these is the careless squandering of pence to beggars, and the consequent fostering of idleness and vice. Sometimes because their sympathies are so quick that they can not tolerate the sight of real or apparent misery; sometimes because they quiet their consciences and think they compound for misdeeds by occasional *largesse;* sometimes because they are moved by that other-worldliness which hopes to obtain large gifts hereafter by small gifts here; sometimes because, though conscious of mischief likely to be done, they have not the patience needed to make inquiries, and are tempted to end the matter with a sixpence or something less; men help the bad to become worse. Doubtless the evil is great, and weighs much against the individual exercise of beneficence—practically if not theoretically.

The same causes initiate and maintain the begging-letter impostures. Occasional exposures of these in daily papers might serve as warnings; but always there is a new crop of credulous people who believe what they are told by cunning dissemblers, and yield rather than take the trouble of verification; thinking, many of them, that they are virtuous in thus doing the thing which seems kind, instead of being, as they are, vicious in taking no care to prevent evil. That the doings of such keep alive numbers of scamps and swindlers, every one knows; and doubtless a considerable set-off to the advantages of individual beneficence hence arises.

Then, again, there meets us the objection that if there is no compulsory raising of funds to relieve distress, and everything is left to the promptings of sympathy, people who have little or no sympathy, forming a large part of the community, will contribute nothing; and will leave undue burdens to be borne by the more sympathetic. Either the requirements will be inadequately met or the kind-hearted will have to make excessive sacrifices. Much force though there is in this objection, it is not so forcible as at first appears. In this case, as in many cases, wrong inferences are drawn respecting the effects of a new cause, because it is supposed that while one thing is changed all other things remain the same. It is forgotten that in the absence of a coercive law there often exists a coercive public opinion. There is no legal penalty on a lie, if not uttered after taking an oath; and yet the social disgrace which follows a convicted liar has a strong effect in maintaining a general truthfulness. There is no prescribed punishment for breaking social observances; and yet these are by many conformed to more carefully than are moral precepts or legal enactments. Most people dread far more the social frown which follows the doing of something conventionally wrong, than they do the qualms of conscience which follow the doing of something intrin-

sically wrong.* Hence it may reasonably be concluded that if private voluntary relief of the poor replaced public compulsory relief, the diffused sentiment which enforces the one would go a long way toward maintaining the other. The general feeling would become such that few, even of the unsympathetic, would dare to face the scorn which would result did they shirk all share of the common responsibility; and while there would probably be thus insured something like due contributions from the indifferent or the callous, there would, in some of them, be initiated, by the formal practice of beneficence, a feeling which in course of time would render the beneficence genuine and pleasurable.

A further difficulty presents itself. "I am too much occupied," says the man of business when exhorted to exercise private beneficence. "I have a family to bring up; and my whole time is absorbed in discharging my responsibilities, parental and other. It is impossible for me, therefore, to make such inquiries as are needful to avoid giving misdirected assistance. I must make my contribution and leave others to distribute." That there is force in the reply can not be denied. But when we call to mind the common remark that if you want anything done you must apply to the busy man rather than to the man of leisure, we may reasonably question whether the busy man may not occasionally find time enough to investigate cases of distress which are forced on his attention. Sometimes there may even result, from a due amount of altruistic action, a mental gain conducive to efficiency in the conduct of affairs.

At any rate it must be admitted that individual ministration to the poor is the normal form of ministration; and that, made more thoughtful and careful, as it would be if the entire responsibility of caring for the poor devolved upon it, it would go a long way toward meeting the needs: especially as the needs would be greatly diminished when there had been excluded the artificially generated poverty with which we are surrounded.

But now, from this general advocacy of individual giving *versus* giving by public and quasi-public agencies, I pass to the special advocacy of the natural form of individual giving—a form which exists and which simply needs development.

Within the intricate plexus of social relations surrounding

* A most instructive and remarkable fact, which illustrates this general truth at the same time that it illustrates a more special truth, is that respecting the rudest of the Musheras of India, who have no form of marriage, but among whom "unchastity, or a change of lovers on either side, when once mutual appropriation has been made, is a thing of rare occurrence"; and, when it does occur, causes excommunication. So that among these simple people, public opinion in respect of the marital relation is more potent than law is among ourselves. (For account of the Musheras see Calcutta Review, April, 1888.)

each citizen, there is a special plexus more familiar to him than any other, and which has established greater claims on him than any other. Every one who can afford to give assistance, is brought by his daily activities into immediate contact with a cluster of those who by illness, by loss of work, by a death, or by other calamity, are severally liable to fall into a state calling for aid; and there should be recognized a claim possessed by each member of this particular cluster.

In early societies, organized on the system of *status*, there went, along with the dependence of inferiors, a certain kind of responsibility for their welfare. The simple or compound family group, formed of relatives standing in degrees of subordination, and usually possessing slaves, was a group so regulated that while the inferiors were obliged to do what they were told, and receive what was given to them, they usually had a sufficiency given to them. They were much in the position of domestic animals in respect of their subjection, and they were in a kindred position in respect of due ministration to their needs. Alike in the primitive patriarchal system and in the developed feudal system, we see that the system of *status* presented the general trait, that while dependents were in large measure denied their liberty, they were in large measure supplied with the means of living. Either they were directly fed and housed, or they were allowed such fixed proportion of produce as enabled them to feed and house themselves. Possession of them unavoidably brought with it care for them.

Along with gradual substitution of the system of contract for the system of *status*, this relation has been changed in such manner that while the benefits of independence have been gained the benefits of dependence have been lost. The poorer citizen has no longer any one to control him; but he has no longer any one to provide for him. So much service for so much money, has become the universal principle of co-operation; and the money having been paid for the service rendered, no further claim is recognized. The requirements of justice having been fulfilled, it is supposed that all requirements have been fulfilled. The ancient *régime* of protection and fealty has ceased, while the modern *régime* of beneficence and gratitude has but partially replaced it.

May we not infer, with tolerable certainty, that there has to be re-instituted something akin to the old order in a new form? May we not expect that without re-establishment of the ancient power of superiors over inferiors, there may be resumed something like the ancient care for them? May we not hope that without the formation of any legal ties between individuals of the regulating class, and those groups whose work they severally

regulate in one or other way, there may come to be formed stronger moral ties? Already such moral ties are in some measure recognized. Already all householders moderately endowed with sympathy, feel bound to care for their servants during illness; already they help those living out of the house who in less direct ways labor for them; already from time to time small traders, porters, errand-boys, and the like, benefit by their kind offices on occasions of misfortune. The sole requisite seems to be that the usage which thus shows itself here and there irregularly, should be called into general activity by the gradual disappearance of artificial agencies for distributing aid. As before implied, the sympathetic feelings which have originated and support these artificial agencies, would, in their absence, vitalize and develop the natural agencies. And if with each citizen there remained the amount now taken from him in rates and subscriptions, he would be enabled to meet these private demands: if not by as large a disbursement, yet by a disbursement probably as large as is desirable.

Besides re-establishing these closer relationships between superior and inferior, which during our transition from ancient slavery to modern freedom have lapsed; and besides bringing beneficence back to its normal form of direct relation between benefactor and beneficiary; this personal administration of relief would be guided by immediate knowledge of the recipients, and the relief would be adjusted in kind and amount to their needs and their deserts. When, instead of the responsibility indirectly discharged through poor-law officers and mendicity societies, the responsibility fell directly on each of those having some spare means, each would see the necessity for inquiry and criticism and supervision: so increasing the aid given to the worthy and restricting that given to the unworthy.

And here we are brought face to face with the greatest of the difficulties attendant on all methods of mitigating distress. May we not by frequent aid to the worthy render them unworthy; and are we not almost certain by helping those who are already unworthy to make them more unworthy still? How shall we so regulate our pecuniary beneficence as to avoid assisting the incapables and the degraded to multiply?

I have in so many places commented on the impolicy, and indeed the cruelty, of bequeathing to posterity an increasing population of criminals and incapables, that I need not here insist that true beneficence will be so restrained as to avoid fostering the inferior at the expense of the superior—or, at any rate, so restrained as to minimize the mischief which fostering the inferior entails.

Under present circumstances the difficulty seems almost insurmountable. By the law-established and privately established agencies, coercive and voluntary, which save the bad from the extreme results of their badness, there have been produced unmanageable multitudes of them, and to prevent further multiplication appears next to impossible. The yearly accumulating appliances for keeping alive those who will not do enough work to keep themselves alive, continually increase the evil. Each new effort to mitigate the penalties on improvidence, has the inevitable effect of adding to the number of the improvident. Whether assistance is given through State-machinery, or by charitable societies, or privately, it is difficult to see how it can be restricted in such manner as to prevent the inferior from begetting more of the inferior.

If left to operate in all its sternness, the principle of the survival of the fittest, which, as ethically considered, we have seen to imply that each individual shall be left to experience the effects of his own nature and consequent conduct, would quickly clear away the degraded. But it is impracticable with our present sentiments to let it operate in all its sternness. No serious evil would result from relaxing its operation, if the degraded were to leave no progeny. A short-sighted beneficence might be allowed to save them from suffering, were a long-sighted beneficence assured that there would be born no more such. But how can it be thus assured? If, either by public action or by private action, aid were given to the feeble, the unhealthy, the deformed, the stupid, on condition that they did not marry, the result would manifestly be a great increase of illegitimacy; which, implying a still more unfavorable nurture of children, would result in still worse men and women. If instead of a "submerged tenth" there existed only a submerged fiftieth, it might be possible to deal with it effectually by private industrial institutions, or some kindred appliances. But the mass of effete humanity to be dealt with is so large as to make one despair; the problem seems insoluble.

Certainly, if solvable, it is to be solved only through suffering. Having, by unwise institutions, brought into existence large numbers who are unadapted to the requirements of social life, and are consequently sources of misery to themselves and others, we can not repress and gradually diminish this body of relatively worthless people without inflicting much pain. Evil has been done and the penalty must be paid. Cure can come only through affliction. The artificial assuaging of distress by State-appliances, is a kind of social opium-eating, yielding temporary mitigation at the eventual cost of intenser misery. Increase of the anodyne dose inevitably leads by and by to increase of the evil; and the

only rational course is that of bearing the misery which must be entailed for a time by desistance. The transition from State-beneficence to a healthy condition of self-help and private beneficence, must be like the transition from an opium-eating life to a normal life—painful but remedial.

ARE THERE EVIDENCES OF MAN IN THE GLACIAL GRAVELS?

By Major J. W. POWELL.

THE geologist studying in the Rocky Mountains is ever astonished at the rapid degradation of mountain forms. Cliffs, peaks, crags, and rocky scaurs are forever tumbling down. The rocks break asunder above and roll down in great slides on the flanks and about the feet of the mountains. As the slopes are thus diminished, gradually the slides are covered with soil, in part through the decay of the rocks themselves, in part by wind-drifted sands, but perhaps in chief part by the washing of the soils above. In this manner a great mountain is ultimately buried by overplacement. This overplacement gradually washes down, to be distributed on still lower grounds, but it is replaced from above from the newly formed soils. The process goes on until the mountain is degraded into hills and the streams have carried away the greater part of the material of the ancient mountain. Now, in studying these mountains, the geologist is always on his guard to distinguish overplacement from foundation structure. When the mountains are all gone the hills are degraded in the same manner, and the process continues until a grand base-level is established, below which degradation can not take place; then the mountains and hills have all been carried away by rivers to the sea. As mountains and hills are degraded, so valley slopes are brought down. The river, meandering now on this side and now on that, increases the length of its course, as every bend throughout the valley is cut back; but ultimately bend works back against bend, until shorter channels are produced. By cut-off channels the course of the river is diminished; by increasing its meanders the course of the river is lengthened; but in the grand operation the one about compensates for the other. In this manner the river is forever rearranging the flood plain. The banks of the stream, left dry by the vicissitudes of river cutting, tumble down, and a bank goes through a process much like that of the mountain slope; and the geologist is ever on the lookout to distinguish overplacement from the rocks of the foundation structure. There are many conditions where this distinction is plain,

but there are many other conditions where it is obscure. Let us see how some of these obscurities arise.

In the United States and in British America there is a vast district of country covered with glacial drift. In a period known to geologists as the Glacial epoch deep snows and gigantic accumulations of ice extended from a region far to the northward down into the United States, nearly to the mouth of the Ohio River. The margin of this great ice field stretched from this central point eastward and northward to the Atlantic Ocean, and westward and northward to the Great Plains, while the Rocky Mountains were covered with great ice fields. This enormous ice sheet was ever working southward, and ever melting along its southern boundary. As it moved southward it plowed the mountains, dug down the hills, and generally filled the valleys with the *débris*; and it spread over much of the great area a vast sheet of rounded gravels, sands, and clays; and it fed the streams from the border of the ice sheet with fine silt that was distributed along the valleys to the Gulf of Mexico. This glacial flour is now recognized as the loess of the South. Since the disappearance of the great ice sheet the glacial formations that were made by it cover much of the dry land. Now, these glacial formations, being composed of incoherent bowlders, gravels, sands, and clays, are pretty easily distinguished from the underlying, more indurated rocks; but rains, brooks, creeks, and rivers have been at work carving new valleys, and remodeling the bluffs, hills, cliffs, and mountains of all the country, and in the process have distributed over the land formed by the glacial ice extensive bodies of overplacement. This overplacement is incoherent, like the glacial formations. There is no difficulty in distinguishing the overplacement from the primeval foundation, but there is great difficulty in distinguishing it from the glacial formations, and it requires nice powers of observation to always make the distinction with certainty. The criteria for distinguishing overplacement from the original glacial formations have been gradually discovered and formulated in the last few years.

In 1882, by act of Congress, the Geological Survey was authorized and directed to make a geological map of the United States. The survey entered upon this work in different parts of the country. Among many problems before it, one of the more important was that of mapping the glacial formations, and in order to do it two things were necessary: First, it was necessary to distinguish the glacial formations from modern overplacement; second, it was necessary to study the history of the glacial action and the various structures which the ice produced, for there are many—such as moraines, osars, kames, and bodies of till, sand, gravel, and bowlders; and it was sought to discover the history of their forma-

tion, and especially the history of the entire Glacial epoch. The members of the Geological Survey engaged upon the general work were only to a limited extent occupied with this problem. In the special fields where they were engaged in studying the primeval foundation rocks they also studied the glacial formations and the modern overplacements. But the field was very large, and many geologists in the country had already made observations and engaged in researches of this character. Most of these geologists were professors in the various colleges of the country, and it was decided by the director to enlist these professorial geologists as far as possible to continue the work and solve these problems for the general survey of the United States upon the foundation of observation already begun by them. For this purpose Prof. Chamberlin, then of Beloit College, with Prof. Salisbury, his associate, and many other professorial assistants, were engaged upon the work. Prof. Shaler, of Harvard University, was also enlisted, with a large corps of assistants. Prof. Emerson, of Amherst College, was likewise enlisted, with his assistants; and Prof. Davis, of Harvard University, with his assistants, also took a part. Mr. Gilbert, of the Geological Survey, with his assistants, was studying the lake basins of the far West, but, as their history was involved in the history of the glacial formations, he incidentally took part in this work. Mr. McGee, permanently employed upon the survey, with his assistants, was engaged in studying the estuarine and coastal-plain formations of the Atlantic slope, and he soon discovered that they were involved with the glacial deposits that had come down from the Appalachian Mountains. Besides the men thus occupied, many other volunteers, as professors and students, took part in the work, now here, now there; so that altogether more than fifty different men engaged in the solving of these great problems. Nearly all the men who engaged in this work soon discovered that the preliminary problem was to formulate the criteria by which modern overplacement is to be distinguished from original glacial formation. As this proceeded it was further discovered that much of the confusion in the study of the glacial rocks themselves was cleared away, and that it was possible to read the record of the old Glacial epoch in such a manner as to discover its history.

So the work went on year after year, in small part by the regular employees of the survey, in chief part by a professorial corps, aided by many volunteers, often university students. Then many of the State geologists were enlisted, and the work proceeded, until at last a vast body of facts has been collected. The men often conferred with one another and visited doubtful points together. The officers of the Geological Survey, the professorial geologists, and the State geologists thus associated themselves

voluntarily, and made many excursions together. For example, Mr. McGee believed that he had made some discoveries in Alabama and Mississippi which were inconsistent with conclusions reached by State geologists. Thereupon he conferred with Messrs. Hilgard, formerly of Mississippi, now of the University of California; Smith, of Alabama; Holmes, of North Carolina; Safford, of Tennessee; Hill, of Texas; and Ward, paleobotanist of the Geological Survey; and they visited the region together, all having distinct views somewhat differing from one another. They examined the problems concerning which differences of opinion had arisen, and they all united in a common conclusion. Subsequently Messrs. Chamberlin and Salisbury visited the same region in company with Mr. McGee, and came to substantial agreement with the first party. Such instances of harmonious co-operation have occurred again and again in all portions of the glaciated area. The whole body of men engaged in the research worked together for a common purpose, and were unwilling to publish material conclusions until the facts could be submitted to many minds. They worked with a harmony and a patience for dissenting opinion worthy of such a body of scientific men. Mr. Chamberlin, first the Professor of Geology at Beloit College, afterward President of the University of Wisconsin, and now in charge of the geological department of the new University of Chicago, had the largest share in all this work; he gave more time to it himself and he employed more assistants than any one else; in fact, he was considered the Nestor of the work. He had long before been the State Geologist of Wisconsin, where glacial formations are highly developed, and had made a special study of the subject, and all the workers in the field deferred largely to his judgment in suggesting methods of research.

Occasionally some observer failed to make the necessary discriminations, and dropped out of the work. Among others whom Prof. Chamberlin enlisted was Prof. G. F. Wright, of Oberlin College, who devoted some summer months to these investigations. Now, some of the observations made by Prof. Wright were of value, but he seemed to fail to distinguish overplacement from glacial formation; and, after trying him for two or three seasons, his labors were dispensed with. Thereupon Prof. Wright commenced the preparation of a popular work upon the history of the Ice period. When this came to the knowledge of Prof. Chamberlin, he demurred. Still, Prof. Wright continued his work, and ultimately published his book. On its appearance it was found that he had ignored the conclusions of his co-workers—had practically denied the accuracy of their observations—and had published a work on the history of the Ice period which they believed to be erroneous and misleading. But they let the subject pass

with no unfavorable criticism, believing that ultimately the grand results of the combined labors of so many men, when published, would correct all errors.

There is another phase to this question, connected with the science of archæology. I have already set forth the distinction which geologists recognize between overplacement formations and fundamental formations. Certain archæologic problems which have sprung up in late years in the United States are profoundly affected by the discovery and formulation of these distinctions. Many years ago a local observer at Natchez, Miss., claimed to have discovered a human skeleton in the loess of a bluff on the Mississippi River. The loess is a formation contemporaneous with the glacial formation of the North, as previously explained. The discovery of a human skeleton in this situation was believed to prove that man dwelt in the valley of the Mississippi during the loess-forming epoch. The discovery seemed to be of so much importance that the site was visited by Sir Charles Lyell, who on examination at once affirmed that the skeleton was not found in the loess itself, but in the overplacement or modified loess—that is, in the talus of the bluff; and all geologists and archæologists have accepted the decision.

From time to time other supposed discoveries were made in this country; but one after another was abandoned, until a series of discoveries were made along the line of hills which stretch from the Hudson to the James River. This line of hills marks an interesting geological displacement. The country to the seaward of the line has been differentially displaced from the country mountainward by an uplift on the Appalachian side or a downthrow on the ocean side, or both. The displacement has given rise to many rapids and falls in the streams. Above this line of displacement the waters are not navigable, the declivity of the streams being too great; below, tidewater always flows to the foot of the hills. Now, along this line of hills, back and forth from the upper country to the lower, are many glacial gravels, many hills of ancient river gravels, and many hills of estuarine gravels, all of Glacial age. But there are other gravels of still greater age intimately associated with them, and in making the geological survey of the country it became necessary to distinguish the older gravels of Neocene and Cretaceous age from the younger gravels of the Ice period, and it also became necessary to distinguish the overplacement of modern times. In these same gravels certain archæologists had discovered what they believed to be palæolithic implements; and as some of the gravels were known to be of Glacial age, they supposed them all to be Glacial, and that they thus had evidence that man inhabited the country during the Glacial epoch. These implements were gathered

in very great numbers and collected in various museums in the United States, and many collections were sent abroad to the great museums of the world. Several different collectors engaged in this enterprise for some years, and acquired great reputation for their proof of the antiquity of man on this continent, and for their zeal in discovering the evidence; and to recompense them for this work they were made members of many scientific societies throughout the world, and decorated with ribbons, and some were knighted. Geologists, however, held the question more or less in abeyance, not feeling sure of the geological evidence for the age of the formations in which the supposed stone implements were found. Then other discoveries were made in Minnesota and elsewhere; and finally geologists, with some misgivings and many ifs and perchances, accepted the conclusion that Glacial man in America was a reality.

But now the problem of these formations had to be studied geologically in making the map of the United States, for they had to be represented thereon. They were soon found to be of different ages, but had been confused by reason of the overplacement which is so abundant everywhere. At the same time a new class of archæologic investigations began. The first new work of the character was undertaken in the neighborhood of Washington, on Piny Branch. It had been discovered that the gravels of this locality were of Cretaceous age, and if the flaked stones supposed to be found therein were really deposited *in situ*, then man in America was not only of Glacial age but of Cretaceous age, for the very same class of implements which the Indians made two centuries ago in the valley of the Potomac were also supposed to be found in the Cretaceous gravels as well as in the gravels of the Glacial epoch. Thereupon Mr. Holmes, of the Bureau of Ethnology in the Smithsonian Institution—not a member of the Geological Survey—undertook the investigation, and he commenced by trenching the hills, and worked patiently for months at the problem. He proved that all the supposed stone implements belonged, not in the foundation rocks of Cretaceous age, but in the overplacement. Man, then, was not of Cretaceous age. While these investigations were in progress the American Association and the International Geologic Congress met in Washington, and many of the scientific men visited the ground. Most of the assistants of the Geological Survey visited it, and other geologists, attracted by the problem, came to Washington for the purpose; so that the whole field was surveyed and the evidence weighed by very many of the geologists of the country and of the world, and they all agreed that the stone implements belonged to the overplacement, and might possibly have been deposited within the last three hundred years.

But there were many like finds in Neocene gravels and gravels of Glacial age stretching down into Virginia and northward through Pennsylvania and New Jersey. One after another these gravel sites were explored by Mr. Holmes and his assistants in the same manner, and in every instance it was revealed that the stone objects were found in the overplacement, that in no case could they be found in the underlying rocks. Objects of the same character have been observed all over the United States. Within the last twenty years the writer of this article has seen them made by Indians in the Rocky Mountain region, and they are scattered far and wide over nearly all the gravel hills of this country. This creates a presumption that, where there are so many of modern origin, all may be modern. It has already been mentioned that certain implements of this kind had been found in gravels, supposed to be of Glacial age, in Minnesota. This is known as the Babbitt find. Finally, Mr. Holmes, together with Prof. Winchell, the State Geologist of Minnesota, visited the locality. They made careful examinations, and were entirely satisfied with the evidence that the stone objects of that site were found in overplacement.

Up to this stage one locality had not been examined with care by the new methods—the locality in Trenton, which had especially become historic by reason of the many collections made therefrom for sundry museums; and this Mr. Holmes finally visited. The implements collected had been found mainly, perhaps not wholly, along old banks of streams, and two localities of this nature had furnished many of the objects of the museums. When visited by Mr. Holmes and other geologists, implements could not be found save in the overplacement. The principal of these sites was a low bluff of gravel in the city of Trenton, and property conditions prevented thorough examination of the site by trenching; thus it seemed that final observation by the new methods was no longer possible. But at this stage the authorities of the city of Trenton commenced to dig a sewer parallel to the bluff and but a few steps back from its face—a deep trench to carry a large body of sewage to a distance where it would no longer be noxious to the inhabitants. Shortly after this work began Mr. Holmes again visited the place, and returned from time to time during its progress, and for upward of a month kept an expert assistant watching the progress of the digging. With all the examination made no stone implement was ever found. This led him to the conclusion that the flaked stones originally found on the bank really belonged to the overplacement and not to the foundation formation of Glacial age.

In the fall of 1889 the writer visited Boise City, in Idaho. While stopping at a hotel some gentlemen called on him to show

him a figurine which they said they had found in sinking an artesian well in the neighborhood at a depth, if I remember rightly, of more than three hundred feet. The figurine is a little image of a man or woman done in clay and baked. It is not more than an inch and a half in length, and is slender and delicate, more delicate than an ordinary clay pipestem, and altogether exceedingly fragile. Hold the figurine at the height of your eye and let it fall on the hearth at your feet, and it would be shivered into fragments. It was claimed that this figurine had been brought up from the bottom of an artesian well while the men were working, or about the time that they were working at the well, and that as it came out it was discovered. When this story was told the writer, he simply jested with those who claimed to have found it. He had known the Indians that live in the neighborhood, had seen their children play with just such figurines, and had no doubt that the little image had lately belonged to some Indian child, and said the same. While stopping at the hotel different persons spoke about it, and it was always passed off as a jest; and various comments were made about it by various people, some of them claiming that it had given them much sport, and that a good many "tenderfeet" had looked at it and believed it to be genuine; and they seemed rather pleased that I had detected the hoax. When I returned to Washington I related the jest at a dinner table, and afterward it passed out of my mind. In reading Prof. Wright's second book I had many surprises, but none of them greater than when I discovered that this figurine had fallen into his hands, and that he had actually published it as evidence of the great antiquity of man in the valley of the Snake River.

Consider the circumstances. A fragile toy is buried in the sands and gravels and bowlders of a torrential stream. Three hundred feet of materials are accumulated over it from the floods of thousands of years. Then volcanoes burst forth and pour floods of lava over all; and under more than three hundred feet of sands, gravels, clays, and volcanic rocks the fragile figurine remains for centuries, under such magical conditions that the very color of the burning is preserved. Then well-diggers, with a pump drill, hammer and abrade the rocks, and bore a six-inch hole down to this figurine without destroying it, and with a sand-pump bring it to the surface, to be caught by the well-digger; and Prof. Wright believes the story of the figurine, and places it on record in his book!

There are some other cases that ought to be considered, but none of them differs greatly from those given, and enough has already been said.

Now it must here be confessed that a large number of geologists some years ago were willing to acknowledge the validity of

the evidence of Glacial man. Many of them had committed themselves to it, and yet when better evidence was brought they were willing to withdraw opinions previously affirmed. The writer himself has entertained a belief in the existence of Glacial man, and there is still some evidence in California that has not yet been examined by the new methods, and it may be that this evidence is good. The writer has much linguistic material that points to the high antiquity of man on this continent. So we will all withhold final judgment until the evidence is in, being perfectly willing to believe in Glacial man, or Tertiary man, or Cretaceous man, if the evidence demands it, and being just as willing to believe that man was introduced on this continent within the last two thousand years, if the evidence demands it. What care we what the truth is, if it is the truth?

Some years ago Mr. McGee found in a lake formation of the West a stone implement, like those still made by the Indians of that country, in beds of an age not greatly differing from those of the gravels of the Eastern shore; and he published his find. In after years he had learned to distinguish overplacement from foundation formation, and he questioned his own conclusions. This was before the present controversy arose, before Mr. Holmes had so skillfully trenched the hills and shown the true age of the stone implements of the Atlantic slope; but still Mr. McGee, warned by his own observations of the difference between overplacement and under-formation, concluded that he might have been too hasty, and published a long article on the subject, from which the following extract is made:

"It is a fair presumption that any unusual object found within, or apparently within, an unconsolidated deposit is an adventitious inclusion. Every cautious field geologist accustomed to the study of unconsolidated superficial deposits quickly learns to question the verity of apparently original inclusions; he may, it is true, exhaust the entire range of hypothesis at his command without satisfying himself that the inclusion is adventitious; yet he is seldom satisfied that he has exhausted the range of possible hypothesis as to the character of the inclusion, and hesitates long before accepting any unusual association as veritable. His case is not that of the invertebrate paleontologist at work in the Palæozoic rocks, to whom a single fossil may carry conviction; for not only are the possibilities of adventitious inclusion indefinitely less in solid strata, but the mineral character of the fossil is commonly identical with that of its matrix, and so affords inherent evidence of the verity of the association. Nowhere, indeed, in the entire range of the complex and sometimes obscure and elusive phenomena of geology is there more reason for withholding final judgment based upon unusual association than in the

unconsolidated superficial deposits of the earth; and it is only where there is collateral evidence that such testimony is acceptable to the cautious student. Now, the sediments of Lake Lahontan are generally, and in Walker River cañon almost wholly, unconsolidated, and so the probabilities are against the verity of the association."*

When Prof. Wright's second book, Man and the Glacial Period, appeared, the subject was one of popular interest, and it was thought that the book would do harm. Thereupon his fellow-workers criticised the book in various scientific journals, and sometimes spoke very disparagingly of it, as being unworthy of acceptance—all intended to warn the public against a book widely advertised and circulated as the greatest contribution that had ever been made to glacial geology. The fact that in support of his pretensions the author, Prof. Wright, signed his name as a member of the United States Geological Survey, was especially offensive to the others who had been engaged under the auspices of the survey, whether as volunteers, professorial assistants, or permanent employees.

When Prof. Wright found his book thus attacked, he skillfully evaded the real issue—the truth or error of his conclusions—and he or certain of his personal friends raised the cry of persecution by the official geologists of the United States. Most of those who criticised him were professorial geologists, like himself, who had aided the Geological Survey with their work. Prof. Wright was thus attacking his fellow-workers in the field, not deigning to make scientific reply to scientific objections, but making only general statements in relation thereto, and turning the issue on the right of geologists to criticise his work, which he assumed was not official, though he had placed his name on his book with an official title.

All this required no reply from me, until at last Mr. Wright enlisted the championship of The Popular Science Monthly. An article by Mr. Claypole, of Ohio, was published in the April number of the journal, making a bitter attack upon the professorial geologists and upon the regular employees of the United States Geological Survey, and in no covert way attacking the administration of the survey itself. This attack, based as it was on error in every paragraph, would still have called for no response from myself, but would have been passed by, had not the editor of the journal attempted to draw a lesson therefrom in condemnation of the work of the Geological Survey and of that of the professorial geologists and volunteer assistants connected with the universities, colleges, and State surveys of the entire

* American Anthropologist, vol. ii, 1889, pp. 301–312.

country. It seems now to be incumbent upon me to make a simple explanation of the facts. This I have done briefly, with confidence that the editor of The Popular Science Monthly, finding that he has been misled in the matter, will cheerfully correct the impression that his editorial will naturally make upon those unacquainted with the circumstances.

For more than twenty years the writer of this article has been engaged in conducting and supervising scientific research in various portions of the United States. During the history of this work there have been published under his auspices about two hundred volumes, as annual reports, monographs, bulletins, and other miscellaneous works. In all this body of literature there is very little of controversy. The hundreds of men employed have worked together in practical harmony. They have not always agreed, but agreement has been singularly common, and when disagreements have arisen they have been stated courteously and with little exhibition of temper. It is believed that no other publications of the same magnitude can be found in the world where so little controversy is shown and where disagreement is so uniformly courteous. There have been some controversies, but they have been confined to the journals, and have not found their way into the official publications. And the journalistic controversies have been very few; and in only two instances within my knowledge have they been bitter, the case of this book being one of them. The controversy on this subject has not appeared in the official publications, but only in the journals. It has been wholly unofficial.

Prof. Wright stands almost alone in his advocacy of a scientific doctrine. He has a few sympathizers, and some defenders of portions of his theory, but the great body of his work is repudiated by nearly every geologist in America, and especially by the professorial corps. The controversy which broke out in the journals was at the time unknown to the Director of the Geological Survey. He was away from home and an invalid. He had never by word or circumstance directed or suggested it, and knew nothing of it until after it had occurred. Most of the gentlemen who engaged in it and expressed their indignation at what they believed to be a pseudo-scientific work, were connected with universities and colleges, and were wholly out of the jurisdiction of the Geological Survey. Nor are they men accustomed to brook such dictation. Only one of the controversialists was a permanent member of the Geological Survey.

After the above statement, it only remains for the editor of The Popular Science Monthly to render that judgment which the facts demand.

MORAL LIFE OF THE JAPANESE.

By Dr. W. DELANO EASTLAKE.

AMONG the many interesting features that a close acquaintance with Japan and its people reveals to foreigners, the ethics of the Japanese will surely claim the paramount attention of the ethnologist. The people are unlike any other; and we find that this strong national individuality—so fascinating to visitors to Japan—reaches far beyond the quaint homes, graceful costumes, obsequious courtesy of both rich and poor, and the picturesque beauty of the country itself; finding its origin in the very heart of the people, inculcated by the lives and precepts of generation upon generation of warriors, poets, and statesmen.

The moral life of the Japanese has found many exponents in the literature of the Occident, and, on account of the contradictory character of many of the writings on the subject, the ideas gained by the reading public can not be other than confusing and vague. Any just consideration of the ethics of the Japanese admits of no equivocation, and conventional prudery must in all cases be replaced by simple, ungarnished facts. I would neither seek to confirm nor deny the varied statements of other observers, believing that a clearer insight may be gained from a brief portrayal of the various ethical influences—either domestic, social, or religious—that touch the life of the people from early childhood until, after life is done, their mortal remains are packed into a square pine box, not unlike an ordinary dry-goods case, and consigned to the keeping of Mother Earth.

Japan has been frequently referred to as the "Children's Paradise," and with considerable justice, for in no other country is childhood made so much of, and are children surrounded by so many devices for their amusement. In every town there are numbers of street venders and hawkers whose sole customers are children. One class of these venders carry two charcoal stoves, or furnaces, swung in the conventional manner of the country from the ends of a pole which rests across the shoulder. Arriving at a convenient corner, the load is put down, and a group of eager children quickly gather. For the moderate sum of one or two *rin* * the children are each supplied with a tiny cup of sweetened batter and a spoon. Thus equipped, they proceed to bake their own cookies on the smooth iron top of the stoves, fashioning the dainties into whatever shape they please, and when they are crisp and brown, devouring them. The *amé* vender also devotes his skill to

* The Japanese rin is the tenth part of one sen, or cent; 1,000 rin, therefore, equal one yen, or dollar.

children. His "stock in trade" consists of dried reeds and a quantity of *midzu amé*, a sort of malt paste. Some of the *amé*

THE MIDZU-AMÉ ARTIST. An amuser of children, seen in every Japanese city.

is put on the end of a reed, and is molded or blown into some fantastic shape by the vender. The young customers dictate as to

the figures, and butterflies, flowers, gourds, or what not are shaped from the sweet paste. The children, after having satisfied their tastes for artistic design, eat the finished work, the reed handle preventing their fingers from becoming sticky. There is another of the child amusers that can be seen in the streets of Tōkyō or any other Japanese city. This artisan molds fruits, flowers, and

A Buddhist Priest in Full Canonicals.

vegetables from colored rice-flour dough, and does his work so deftly that it is really difficult to distinguish the artificial from the real fruit.

This universal love and regard for children is also displayed at every temple festival, where numerous booths, gay with toys, flags, and games, form always a prominent feature.

And what of the life of and influences surrounding these little folks? Well, the first event of importance after they have been ushered into this world occurs when they are one hundred days old. This is a feast day for the family, in which the baby plays the chief *rôle*. Toys, money, gowns, and sweets are lavished upon him by admiring friends and relatives. Among the poorer classes the baby is then considered old enough to be strapped on the back

of its brother or sister (usually the latter) and to go about with them during the greater part of the day, and from that time spend at least half the day in the open air. As soon as the child is old enough and strong enough to run about, a small doll-like bundle is strapped to its back, the weight of which is frequently increased as the child grows stronger; so, by the time the next arrival in the family has put in an appearance, a well-broken and docile little human "pack-horse" will be found ready for him. The newcomer is put through a similar course of training in due time; and so on, and so on—but let us trust not *ad infinitum!*

The relations between parents and children are entirely natural, free, and unrestrained. The truths of life and Nature are unfolded to them as soon as the children are old enough to inquire about them. Nothing is left for them to learn from outside sources. The result of this perfect candor, so far from developing any undue precocity in the children, serves to preserve that indefinable, unconscious grace, so beautiful in childhood, which, by the secret acquisition of some hidden knowledge, is so apt to be replaced by that glance of definable conscious disgrace seen in the faces of so many prematurely "old" children of the Occident.

There are two national children's festivals during the year: *Sekku*, for boys, and *Ohinasama*, for girls. *Sekku*, or "boys' day," is celebrated on the 5th of May. At this time gifts are made to the boys of the home, and for every male child in the family a huge paper carp (*koi*), of some brilliant hue, is hung out on a pole above the house-top. During this festival a Japanese town looks like a great aërial fish-pond. *Ohinasama*, "the honorable goddess of maidenhood," rules Japanese homes on the 3d of March, provided there are any daughters in the household. It is virtually "dolls' day," for all the dolls hold high carnival, and are brought forth with all their belongings—such as miniature ceremonial tea-sets, ornaments, and utensils—and set out in state; while in the *tokonoma*, or alcove, hangs a silken picture of Ohinasama herself; and a vase filled with odorous blossoms is placed before her. Presents to the daughters of the household, of flowers, cakes, and sweets, are also in order.

The school education of Japanese children begins at the age of six years; and in the primary departments the boys and girls are taught together, although occupying different parts of the school-room. It would be impossible, in this article, to discuss the present status of education in Japan; suffice it to say that there are business colleges, mining and engineering schools, law schools, universities, and even musical conservatories—all of which rank most high. Regarding the education of women, this usually consists in an eight years' grammar-school course, and frequently two or three additional years in the *shihan-gakko*, or normal school.

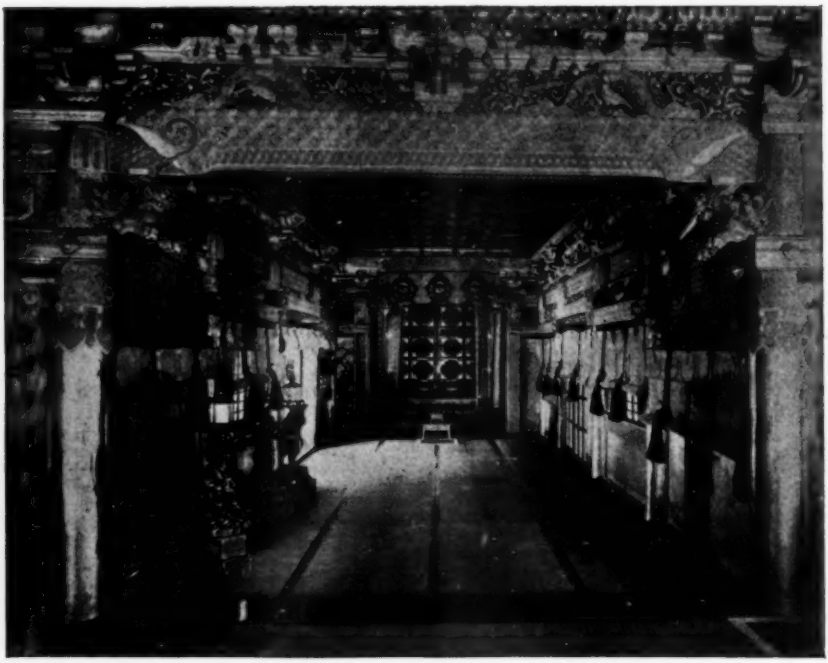
The moral education of Japanese children is conducted partly at home and partly in school, and is based largely upon the teachings of the history of the country. Intrepid valor, zeal, sobriety, directness of speech, extreme courtesy, implicit obedience to parents and superiors, and deferential reverence and regard for old age—

THE INNER GATE LEADING TO THE TOMB OF THE SHŌGUN TOKUGAWA, SHIBA, TŌKYŌ.

these are among the chief characteristics looked for in boys; while industry, gentleness, faithfulness, and cheerful demeanor are required of girls.

Little or no importance is attached to the religious training of children. Whether the parents be Buddhists or Shintoists it

matters not, for in either case the children rarely take any part in the religious life of their parents or elders, and indeed usually grow up in blissful ignorance as to what it is all about. True, they may be occasionally taken to the temple, and taught to rub their palms together, clap thrice, and incline their heads toward the shrine, as they toss their offering of *rin* through the wooden grating of the huge money-till. They may have some vague notion that there is something meritorious in all this, but nothing more, although every Japanese home has a latticed niche, or *kamidana*, dedicated to the service of the household Lares and



INTERIOR OF THE SHRINE AT THE TOMB OF THE TOKUGAWA SHŌGUNS AT SHIBA, TŌKYŌ. Relics of the hero are preserved in the rear.

Penates, or *Daikoku* and *Ebisu* as they appear in Japan. These quaint figures—*Daikoku* with his bag of rice, and *Ebisu* with his wise smile and accompanying fish—are regarded more as symbols of good luck than supreme beings, and are retained, in many homes at least, in the same spirit as we Occidentals would fasten a horseshoe over a doorway.

The entire absence of demonstrative affection in Japanese families seems almost incompatible with the deep feeling of parental and filial love and tenderness that exists. Petting and caressing are dispensed with as soon as babyhood is over; and even during this time the mother but rarely presses her lips to the child's

A Chăya, or Tea House. Showing an interior similar to many Japanese homes.

face, although the ministering love and tender care of the parent are not lessened one whit with the advancing maturity of the child. Again, while the relationship between brothers and sisters is most sincere and cordial, embracing, kissing, or any other caress is never thought of. An old Japanese precept goes so far as to command that, after the age of seven, brothers and sisters should not even sit together; and up to the present dynasty this rule was strictly adhered to. So, when the father of the family would read aloud to the assembled children, the daughters would always sit apart, half hidden by a screen. In contradistinction to these apparently formal relations, brother or sister, even after having attained the age of puberty, will have no hesitation in disrobing or bathing before one another; while the utmost freedom in conversation is admissible. This formality between the sexes, even in the same family, may be briefly summed up in the words, "Hands off!" and apart from this the closest intimacy and affection may exist.

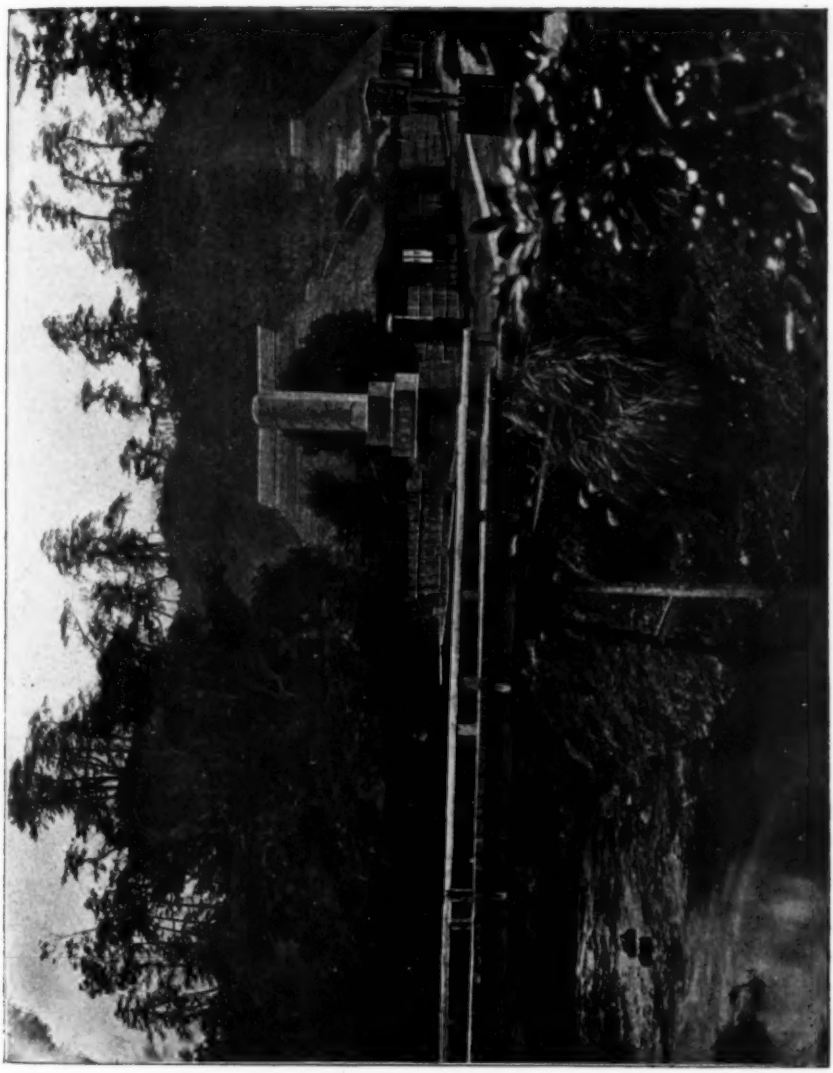
The word "kiss" finds no exact equivalent in the Japanese language; the nearest approach to it being *kuchi-su*, literally "to suck the mouth"—a caress only admissible in conjugal relations. The principal years of a girl's life that are specially celebrated are the third, seventh, and fifteenth, at which latter age she is regarded as a woman, and no longer a child. The most important years of a boy's life are the third, fifth, and fifteenth, and at this last age he is supposed to put off childishness, and is regarded as a man and of age. Besides the two children's festivals already referred to, there are four other minor boys' festivals and four girls' festivals in the year, so that practically every month has its "children's day."

So much for the ethics of child life in Japan; and much that has been said concerning the same holds good also during later years, in so far as the family relationships are concerned. We now can turn to a consideration of the various relationships between the sexes.

Engagements for marriage are either arranged by the parents of both families, while the principals are yet children, or else through the mediumship of a *nakodo*, or go-between, who must be a friend of both families. In the former case, it is usually with the desire of uniting the houses, and the engagement is arranged by the parents while the contracting parties are only infants; or even—conditionally, of course—before the birth of either child. The children thus engaged are brought up to regard each other as affianced, although their relationship toward each other is no more than playmate or friend, until the consummation of the marriage.

When a youth chooses a wife for himself, and has settled upon

his choice, he summons a mutual friend to act as *nakodo*. In this case the engagement is usually of very short duration; frequently not more than a few days or weeks. The *nakodo* arranges



THE HAMLET AND RIVER OF KAMARI.

everything—the dower, the wedding itself, and the subsequent entertainment. The engaged couple may see each other, but never alone. Their previous acquaintance may have been a long one, and the young people themselves may have come to a mutual understanding; but to all intents and purposes the groom elect, prior to the betrothal, has merely been a friend of the family in general. The Occidental custom, or rather usage, which

FUJI-SAN, THE SACRED MOUNTAIN OF JAPAN, FROM TANGO LAKE. It is an inactive volcano, 12,365 feet above the sea.

permits the daughters of the home to entertain their male guests alone, would be regarded as unpardonable in Japan.

As I have said, the engagement is either the matter of a lifetime or else of a few days or weeks. The date of the wedding having been fixed upon, and finally arriving, the first step is taken by the ceremonious removal of the bride's effects to the home of the groom elect. Apart from a nominal civic marriage, which practically only consists in registration, the ceremony is purely of a domestic nature.

The wedding invariably takes place in the groom's house. The bride elect is escorted to her future home by her parents, and is received by a young girl, who acts as the *machi-joro*, "waiting lady," by whom she is conducted to the dressing-room. In the mean time the parents of both parties have assembled in the guests' chamber, with a few intimate friends and the inevitable *nakodo*. Before the *tokonoma*, or alcove, is a lacquered table, in the center of which is a miniature pine tree—the symbol of good fortune and prosperity; and beneath the tree are two miniature figures of an old man and woman, each with a broom—symbols of household thrift and long life; while at the root of the tree is an ancient turtle of bronze, also symbolic of longevity and good fortune. This odd ornament is known as the *takasago*, and is always placed between the bride and groom during the ceremony. There are also in readiness the *me-o-chocho* (male and female butterflies), a boy and a girl of about eight years old, who wait upon the bridal couple and take the place of our "best man" and "maid of honor." The *nakodo* is also present with a nest of three *saké* cups of different sizes, and a supply of hot *saké*, a rice spirit. The bride and groom having taken their places on either side of the *takasago*, the ceremony proper, or *san-san-ku-do*, or "three times three toasts," is next performed. The *nakodo* takes one of the cups and passes it to the groom. It is then filled with *saké* by the "best man," and then the groom drinks and returns the cup to the *nakodo*, who passes it to the bride. It is now filled by the "maid of honor" and emptied by the bride, and again returned *via* the *nakodo* to the groom, and again emptied. This same form is gone through with the two remaining cups, after which the couple are regarded as man and wife. Then the *nakodo*, or parent of the bride, chants the *takasago*, or nuptial ode, as follows:

"Takasagoya, kono ura buné ni,
Ho-o-ageté tsuki morotomo ni, ideshi-o no,
Nami no awaji no shima kageya,
To-oku naruo-no oki sugite,
Haya suminoye ni
Tsuki ni keri."

I will not attempt to render this in verse; approximately it may be Englished as follows:

Takasago, ye married ones, have sailed now
From the bay of lone estate,
The moon of love has risen with the tide of joy
And casts its silver beams upon the waters of your lives.
The shadow of Awaji's Island steals across the rippling bay,
And now the waters are all enshadowed, e'en to Suminoyé—
Let peace and joy remain, for ye are one!

I have endeavored to ingraft the hidden meaning, or *imi*, into the above. Literally the ode would signify but little to us. The chant being finished, the few friends and relatives now offer their congratulations. In the evening there are a general reception and congratulations and good wishes all around. Among the merchant classes it is customary for the *nakodo* to take the bride around among her new neighbors the day after the wedding. The costume of both bride and groom at the wedding is ordinary "full dress," of a somber hue, but it must bear the family crest. Naturally, the details of marriage etiquette differ somewhat according to the social standing of the contracting parties, but the wedding itself always remains the same.

An interesting description of a sumptuous marriage and feast is contained in the following story, which also goes to show that the Japanese fox—that wary beast—also takes a keen interest in weddings:

THE REVENGE OF THE FOX.*

About fifty years ago, when the Shōgun Tokugawa was at the head of the feudal chiefs, there was a prince in the province of Mikawa, whose prime minister was a man of great renown for his wisdom. This minister had lost his wife in the early years of wedlock, after the birth of a little daughter. The child grew to maidenhood, and often wandered far into the woods that surrounded the grounds adjoining the homestead, searching for wild flowers. The thousand sweet odors and the graceful blossoming plants filled her with intense enjoyment. One day she strolled deeper into the odorous shade of the thick forest than was her custom, and discovered a large hole, which she knew was the den of a fox. With childlike whim and thoughtlessness she began to throw little stones into the opening; but when the shadows of the great trees grew longer and longer, she suddenly remembered that the hour was late, and with a flutter of the heart hastened homeward to her father.

* Originally translated into German by F. Warrington Eastlake, Ph. D., and read before the Gesellschaft für Völkerkunde in Ost-Asien.

Full twelve months passed without any noteworthy occurrence. The minister's daughter grew more subtly beautiful day by day, and many noble lovers sought to win her favor. But the

BRONZE BELL IN UYENO PARK, TŌKYŌ.
About the bell are hung the straw sandals of devout pilgrims.

maiden's heart was not unlocked; her eyelids closed upon dreamless slumbers, and her gentle soul knew no dawning thought of love.

Then one morning came, when a gold-bedecked rider with a dazzling retinue drew up before the door of the mansion, and a

servant with low prostrations made known that the son of the prime minister of a neighboring prince had arrived. So soon as the handsome youth had dismounted, he was ceremoniously welcomed, and the cause of his visit inquired into. He answered that the fame of the young girl's beauty had reached his province, and he had hastened hither to ask for her hand in marriage. Greatly overjoyed, the proud father at once gave his consent, and ordered the attendants to summon his daughter; but the young knight interposed, saying that he must return without delay, and wished his bride to accompany him. With courteous mien he added that all necessary arrangements could be equally well carried out upon arriving at his father's house—such as the dower, wedding gifts, and everything relating to the marriage ceremony. No pomp or pageant would lack in fit magnificence by being postponed a little later, and the bride should be heralded by flowers, torches, and the marriage song; but their immediate departure was inevitable.

For a moment the lordly father was silent and embarrassed by doubts; but fearing that he might lose so brilliant a fortune for his only child, he gave his full consent. Within an hour the blushing girl, in bridal robes and splendid draperies, came through the outspread inner doors, and stood in all the "alarm of beauty and troubled pride," ready for the journey. Her waiting maids and servants, who were to accompany her, clustered around her, wondering whence sprang all this blaze of wealth in so short a space of time.

In a moment the *kago* (palanquin) for the bride was brought forth, and before she and her maids could realize the fact, the *kago*, the horsemen, and the courtly suite were in motion. This time the palanquins of the bride and retinue of women took the precedence and headed the rest, as with joyous music, and heralded by the blare of trumpets and roll of drums, the procession left the minister's door. It seemed not long before the bridal cavalcade drew up before a palatial building. The young groom sprang from his saddle, and, hastening to the *kago* of his bride, softly announced that this was his dwelling, and requested her to step out and enter the guest-chamber. She did so, while shadowy servitors bowed low within the halls as they entered. The bride said nothing, but opened her soft eyes half in fright, and then with wonder and admiration, at the beauty of the palace. Stately halls opened into still statelier chambers. Such unrivaled magnificence!—carved cedar, gold lacquer, and vessels of solid gold. In one fairy room, a mimic glade and shady forest with branching stems interlaced, recalled to her the woodland walks at home, while the very air seemed laden with the sweet odor of blossoms and wild flowers she used to gather.

APPROACH TO THE TEMPLE AT NARA.

On either side of the road are stone lanterns, the gifts of worshipers at the temple, and frequently memorials to the dead.

Upon reaching the largest room a regal feast was spread. Here, too, small woodland intricacies and miniature trees were in each nook and niche. The rich luster of the banquet-room, so filled with perfume and brilliancy, with mirrors on the walls, making twin pictures of all this loveliness, utterly bewildered the young bride. Then the groom reassuringly pressed her hand and told her that this feast had been prepared for her and her attendants. Happiness stole over her, and her rosy cheeks seemed to absorb the delight of her lover as he gazed upon her. Joy and gladness pervaded the guests, and the youthful bride tasted with delight the dainty dishes set before her.

Then, suddenly, a war cry resounded through the halls, and clearly could be heard the neighing of excited steeds and the

THE TOMB OF OGURIHANGUAN. A typical Japanese grave. The body is buried in a square casket, and is placed in a crouching position.

clash of drawn swords. The bride sprang up in terror, and her trembling maidens surrounded her as they beheld a full-armed knight, with threatening aspect, ride toward her. She turned quickly to her bridegrom for protection—but where was he? She shrieked, but nothing but the shriek and its echo were heard. Where was the gorgeous palace with all its new-born delights? All had vanished. The stately music and the soft-voiced lutes had ceased. A deadly silence, that seemed like a horrid presence, was all that remained. Bridegroom and friends, paintings and

carvings, vases and embroideries, palace and court were all gone. All was blighted. She and her maidens were standing in the middle of a shady recess in the woods; before her gaped only the dark opening of a fox's hole; and around them, instead of the splendors of the feast table, were refuse, offal, and all manner of offensive things. At this moment a horse and rider galloped up hurriedly beside them, and told the weeping maiden that he was the real son of the neighboring prime minister. He had heard that a deceiver had made use of his name, and had carried off the lovely daughter of the minister of Mikawa. He had come to find the wretch and avenge the dishonor, but had met no one but this little group of weeping girls in the wood.

Good counsel was dearly purchased. Heart-struck, the young bride, with weak hand, motioned him to be silent, for she knew now that she had been enchanted by the cruel fox, and that all that had occurred was a wizard's revenge. Sad and ashamed, with one beseeching glance, she turned away; and with her maids and servants entered her father's house again, and recounted all that had befallen her with browbeaten air, her fair form trembling with apprehension.

The minister was shocked and overcome with emotion, but carefully commanded that the affair should be kept a profound secret; as it was considered an entailed disgrace when a *samurai*, or high noble, or his children, allowed themselves to be bewitched by a fox.

Despite all warnings and every precaution on the part of his minister and his retainers, the rumor of the disgraceful enchantment reached the ears of the prince. He was terribly angry. "Surely, it must be a weak-minded fool," thought he, "who could so easily fall a victim to the intrigues of a fox," and he at once determined to banish the minister and his family from his kingdom. The honorable minister waited upon his princely master, and entreated a milder punishment, but without any success; leave he must with his daughter and servants. He journeyed to a distant province and died soon after, heartbroken by the disgrace. His daughter never married. It is true, her hand was sought by other men of rank, but she had had more than enough experience with her first bridegroom, and refused all others.

This was the revenge of the fox!

. . . . . .

The system of legalized concubinage, still existing in Japan, is far from being akin to polygamy in a social sense. In taking up this question, I am forcibly reminded of Pierre Loti's "Madame Chrysanthème." This story, while in many respects faulty in its portrayal of Japanese life, and at best revealing a rather degrading and unfortunate view, by no means typical except in seaport

towns where the foreign element is strong, nevertheless serves to reflect with considerable truth the attitude of so many—so very many—foreigners toward the women of Japan.

In Japanese households the concubine or *mekaké* occupies a position similar to that of a servant, so far as her rights are concerned. The wife is always the mistress of the house, and looks upon her husband's *mekaké* in the light of a maid. Should the concubine become a mother, she has no claim upon the child, who belongs to her master and mistress, and who is taught to regard them only as his natural parents. Indeed, most frequently a

THE GREAT TEMPLE GATE OF YENGAKUJI.

mekaké is employed in a family for the sole purpose of securing an heir; and no sooner has the child been born and weaned, than the concubine is discharged.

The *mekaké* has no prerogatives above the other servants of the house, and is subject to immediate dismissal whenever the master of the house desires it. No pseudo-marriage, such as suggested by Pierre Loti, ever exists between the master of the house and the *mekaké*. She is simply a convenience, and has been secured from some employment bureau, just as any other servant, and receives regular wages.

Concubines are rarely, if ever, employed by unmarried men—at least among the Japanese; I do not refer to the foreign element—it being regarded as a grave breach of social laws. Where the *mekakés* mostly find a place is in the home of a long-married or childless couple. How does the wife tolerate the presence of the concubine? In the majority of cases, very well; for but few Japanese wives expect absolute loyalty on the part of their husbands.

THE DAI BUTSU AT KAMAKURA. This is the second largest figure of Buddha in Japan. It was formerly inclosed in a temple, but the latter was destroyed by an earthquake several centuries ago.

Although, as a rule, the husband remains true to his wife, he nevertheless is not bound to do so by any legal or moral obligation.

There have been several efforts made by reformers to discountenance the system of concubinage, and to make it illegal. But it would be decidedly a case of "people in glass houses," should the present Emperor of Japan enforce any such law, or allow it to be enacted. For not only is the Emperor himself the child of a *mekaké*, but so is also the present heir apparent to the throne,

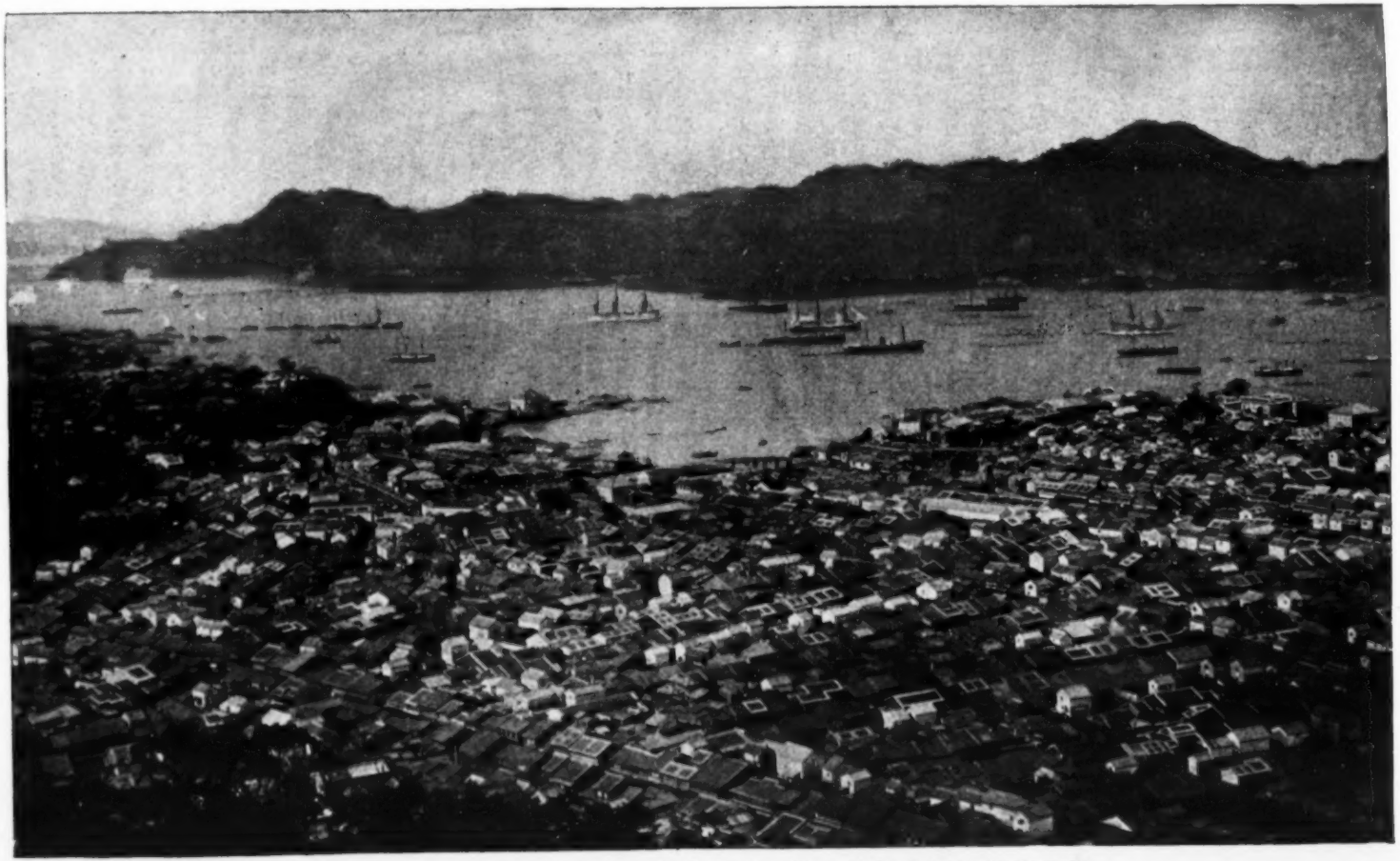
both the Empress Dowager and the present Empress being childless. Then, besides this, the Emperor's household includes several *mekakés* chosen from noble families.

Regarding divorces, up to the present time the husband has always had the privilege of divorcing his wife at will, and sending her back to her parents' home for apparently trivial reasons. But, as easy as it is to sever the nuptial bonds, this privilege is rarely taken advantage of, except in extreme cases, for divorces are looked upon with anything but tolerance by the Japanese. On the other hand, the only thing which warrants a wife in leaving her husband is cruel treatment, in which case she may return to her father's house, and the marriage may be annulled.

There are two other classes of Japanese women that I would make mention of: *geisha*, or professional entertainers, and *jōro*, or prostitutes. The *geisha* is a time-honored institution, and may be seen at almost any public dinner or entertainment. They are professional musicians, dancers, and entertainers in general, and are licensed as such. Frequently the *geisha* will take out a prostitute's license as well. From this it will be understood that what has been said concerning the reserved nature of social and domestic relationships in Japanese society is entirely absent with *geisha*. The women of the Japanese household rarely if ever take part in the public social life of their husbands, and therefore all social or official dinners among men are held at some restaurant or tea-house, and *geishas* employed to furnish music and entertainment. They frequently are accompanied by two or three dancers (*oshakku*), girls between twelve and fifteen years of age, who dance while the *geishas* furnish music and song. The moral instincts of the *geisha* are crude, to say the least, and many progressive Japanese look eagerly forward to the day when the *geisha* will not be an inevitable feature of entertainments.

Prostitution is under strict government control and supervision, and all houses of ill fame relegated to certain portions of the town known as the *yoshiwara*. A prostitute's license is only for three years, for which period of time she sells herself to the keeper of one of these houses for a lump sum. Not infrequently among the poorer families, one of the daughters of the home is thus practically sold to a life of dishonor by her parents, in order to keep the wolf from the door. I know of many sad cases of this kind; and while this heartless procedure is legal, yet it is regarded with equal repugnance and abhorrence by the Japanese public as it would be with us, and is as loudly condemned. After the three years' service is over, the daughter may again return to the parental roof.

Regarding the moral life of women of the poorer classes, it is in the main similar to that of the higher. The maids employed



THE HARBOR OF NAGASAKI. The town is the most southern of the Japanese treaty ports.

by the second-rate hotels and tea-houses bother themselves but little about any moral obligation; but, on the whole, the immorality laid at the door of Japanese women is unjust and misleading.

Regarding the religious life of women as affecting the ethics of the country, little remains to be said. The enamored maiden may write the name of her lover and herself on two strips of paper, and, twisting them together, tie the spell to the lattice work of the temple of *Kwannon*, the goddess of love, trusting that her offering and prayers may be of avail, and unite their lives and hearts.

Religion enters mostly into the lives of the Japanese people when the sands of life are nearly run out. It is then that the people, and more especially the old women, turn to Buddhism or Shintoism with great avidity, and if wealthy will make lavish gifts to the temples, or cause votive stone lanterns to be erected at their expense along the approach to the temples, and will readily yield themselves to the commands of the astute priests, so that they may be assured of future peace and happiness. The Buddhist faith undoubtedly offers the greatest inducements to believers and condemnation to heretics. The Shinto faith, which is the present court religion, is practically a hero worship, and the Shinto priests are not celibates. Some of the more popular saints or deities have been adopted by both creeds—as a matter of policy—notably the "Seven Wise Ones," *Sichi Fuku Jin*, among whom are Daikoku and Ebisu, the household Lares and Penates. In the Shinto temples there are no idols, but relics of the deified hero are preserved; and before the shrine stands a huge mirror of polished metal, into which the worshiper gazes, seeking to place himself face to face with his own soul. In the Buddhist temples there are idols and superstitions galore.

Such are briefly the most salient features of the ethics of the Japanese, in the account of which I have unavoidably been compelled to omit much that is interesting and novel. As I have said, on the whole the Japanese people have been done a great injustice to, when a lack of moral instinct has been charged to them. In no other country, and surely in no other language, has love found an apter exponent. Filial piety, connubial affection, parental tenderness, fraternal fondness—all these have been sung about in Japanese poetry in a thousand dainty ways, and may be daily witnessed in the lives of the people, and above all this is that ardent spirit of patriotism and love for home that so preserves the unity of the Japanese people; and should we seek for the keynote of the wondrous ancient heroism and present rapid advance of the country we will surely find it in the words *Mikune no tame*, "For my country's sake."

EDUCATION AND SELECTION.

By M. ALFRED FOUILLÉE.

MOST of the controversies which are rife in reference to the vital question of education appear to have originated in failure to rise to a sufficiently general point of view of the subject —to a national, international or perhaps an ethnic view. M. M. Guyau, who, in his *Education et l'Hérédité*, has discussed problems relative to morals, religion, æsthetics, and education, from the sociological point of view, has put the question into a really scientific form: Given the hereditary merits and faults of a race, to what extent can we by education modify the existing heritage to the advantage of a new heritage? For nothing less is involved; we have not only individuals to instruct, but a race to preserve and increase. Education, therefore, must rest on the physiological and moral laws of the cultivation of races. We do not overlook this in breeding useful animals, but in dealing with human beings we forget it—as if the education of men was concerned only with individuals.

The ethnic point of view is the correct one. We need, by education, to create hereditary qualities physically and intellectually useful to the race; besides cerebral and physiological heredity, we should assure such social hereditary forms as traditions, customs, social conscience, and public opinion. Society is, in fact, an organism endowed with a certain collective consciousness, although it is not concentrated in a self. We should, therefore, regard as a form of heredity and organic identity through ages, everything that maintains among a people continuity of character, spirit, habits, and aptitudes; in short, a national consciousness and a national will.

It being admitted that the ultimate aim of education is to insure the development of the race, the question arises as to the best means of insuring it. There is one which we desire to set prominently in the light—selection. The history of mankind shows us the struggles of races, nationalities, and individuals—not for life only, but for the progress of life under all its forms, including intellectual, æsthetic, and moral life. In our talk about the struggle for existence we forget the metamorphosis which selection undergoes in passing from the domain of brutal into that of intellectual and moral forces. We have, therefore, to reach a comprehension of the analogies and the differences between natural and social selection. As a first step toward this, we should ask to what extent ideas rule the world, and how a selection of ideas is first induced in the brain by education. We might call this psychological selection. The power of instruction and education,

which some exaggerate and others deny, is simply the force of ideas and feelings. We can not bring too much scientific exactness to the determination of the extent and limitations of this force. We start from the principle that every idea tends to realize itself; and it does so in fact, if it is not counterbalanced by a superior force. The principle of the struggle for existence and of selection is applicable, therefore, to ideas not less than to living individuals and species. A selection is produced in the brain in favor of the strongest and most exclusive idea, which carries the whole organism. The child's brain is a battlefield of ideas and the impulses they generate; every new idea is an additional force encountering ideas already installed and impulses already developed. Education is, then, a work of intellectual selection. Let us suppose a mind still void, into which is abruptly introduced the representation of movement, the idea of some action, as of raising the arm. The idea being solitary and without any counterpoise, the disturbance begun in the brain takes the direction of the arm, because the nerves abutting in the arm have been disturbed by the representation of it; consequently the arm rises. To think of a movement is to begin it. A movement once existing can not be lost, but is communicated as of necessity from the brain to the organs—unless it is arrested by some other representation or impulsion. This propagation of motion is assured physiologically by the symmetry of the limbs, which tend to execute the same movement in succession. The brain provides the theme and the limbs reproduce it, and we have sympathy and synergy of the organs. The contagion of the idea to the limbs is infallible if the idea is solitary or predominant. We call this the law of idea-forces.

Chevreul's well-known experiments with the exploratory pendulum and the divining rod show that, if we represent to ourselves a motion in any direction, the hand will unconsciously realize it and communicate it to the pendulum. The tipping table realizes a movement we are anticipating, through the intervention of a real movement of the hands, of which we are not conscious. Mind-reading, by those who divine by taking your hand where you have hidden anything, is a reading of imperceptible motions by which your thought is translated without your being conscious of them. In cases of fascination and vertigo, which are more visible among children than among adults, a movement is begun the suspension of which is prevented by a paralysis of the will, and it carries us on to suffering and death. When a child, I was navigating a plank on the river without a thought that I might fall. All at once the idea came like a diverging force, projecting itself across the rectilinear thought which had alone previously directed my action. It was as if an invisible arm

seized me and drew me down. I cried out, and continued staggering over the whirling waters, till help came to me. The mere thought of vertigo provoked it. The board lying on the ground suggests no thought of a fall when you walk over it; but when it is over a precipice and the eye takes the measure of the distance to the bottom, the representation of a falling motion becomes intense, and the impulse to fall correspondingly so. Even if you are safe, there may still be what is called the attraction of the abyss. The vision of the gulf as a fixed idea, having produced an "inhibition" on all your ideas and forces, nothing is left but the figure of the great hole, with the intoxication of the rapid movement that begins in your brain and tends to turn the scales of the mental balance. Temptation, which is continual in children because everything is new to them, is nothing else than the force of an idea and the motive impulse that accompanies it.

The force of an idea is greater as the thought is more distinctly selected than others in the consciousness. This selection of an idea that becomes so exclusive that the whole consciousness is absorbed in it has been called monideism. The state is like that of a hypnotized person. The hypnotizer creates an intellectual void in the brain by inducing artificial sleep, and suggests a thought which, being alone and unhampered, is at once realized in movements; and hypnotic suggestion is nothing else than this artificial selection of a single idea to the exclusion of others. The same force of the idea prevails in natural somnambulism. The somnambulist no sooner thinks of anything than he performs it, with his hands and feet as well as with his brain. The movement of the overexcited brain is so lively and the resistance offered by the sleeping organs is so weak that the impulse is communicated to the limbs by the mere fact that it has been conceived. The kind of dream in which children sometimes live is not without some analogy with somnambulism. The fixed idea is another example of the same phenomenon which is produced in the waking state, and increasing may go on to monomania—a kind of unhealthy monideism. Children, having few thoughts, would be likely to have fixed ones, except for the mobility which perpetual novelty causes in them. In this way all the facts may be explained that are grouped under the name of auto-suggestion. Generalizing the law, we might say that every conceived idea is an auto-suggestion, the suggestive effect of which is counterbalanced only by other ideas producing a different auto-suggestion. This fact is especially exemplified in children, who execute very quickly what passes in their heads.

The force of example is likewise brought back to the communicative and selective force of all representation. In the same manner is explained the form of suggestion in which the idea

suggesting the act occurs not to one's self, but is introduced by another. In this line M. Guyau has pointed out a possible application of suggestion in moral therapeutics "as a corrective of abnormal instincts or as a stimulant of too weak normal instincts." He looks upon suggestion as an instinct in the nascent state created by the hypnotizer. Many and important results have been realized from suggestion since his remark was made. Of course, M. Guyau does not advise, but expressly condemns the introduction of hypnotism into normal education. He cites these pathological facts in order to deduce from them consequences relative to the normal condition. He considers hypnotic suggestion as simply the unhealthy and grossly artificial exaggeration of suggestive phenomena which are produced in a state of perfect health. Normal suggestion, which alone should find a place in education, is psychological, moral, and social; it consists in the transmission of ideas or impulsive feelings from one person to another, and in the possibility of fixing them. While in the normal condition we are not under the power of a determined magnetizer, it does not follow that we are not "accessible to an infinity of little suggestions; now acting contrary to one another, now acting cumulatively and producing a very sensible average effect." Children in particular are open to all the suggestions of the medium. The state of an infant on coming into the world is compared by M. Guyau to that of a hypnotized person. There is the same absence of thoughts of its own or the same predominance of a single thought. "Everything that the infant will hear or see will therefore be a suggestion. This suggestion may be the foundation of a habit which may be developing during the child's whole life, as impressions of terror inculcated in children by nurses often do." If the introduction of new feelings is possible by a wholly physiological means, it should be equally possible by psychological and moral means.

Suggestion, which creates artificial instincts capable of balancing hereditary instincts, constitutes a new power comparable with heredity. Education, says M. Guyau, being a collection of co-ordinated and reasoned suggestions, we can understand the importance, the efficiency which it may acquire in both a psychological and a physiological respect. In our own view, suggestion is only a particular instance of the more fundamental law of idea-forces which rules in all pedagogic science.

Ideas have been sometimes despised and treated as having hardly any influence on the conduct. The philosophers of the eighteenth century, with Descartes and Pascal, on the contrary, regarded the feelings and passions as confused thoughts, as "precipitations" of thoughts. There is truth in this. Under all our feelings there is a collection of imperfectly analyzed ideas, a flood

of hasty and confused reasons, on the mass of which we are lifted up and borne off. On the other hand, there are feelings under all our ideas which breed even under the cooling cinders of abstractions. The mind itself has a force, because it arouses all the feelings which it summarizes. Thus the simple words "honor" and "duty" resound through our consciousness in infinite echoes, giving rise to legions of images.

We talk of dead formulas, but they are few. The idea and the word are formulas of possible actions and of feelings ready to pass into acts; they are "verbs." Every feeling, every impulse that comes to the point of formulating itself into a kind of fiat, acquires by that fact a new and in some sort creative force. It finds itself cleared up, defined, specified, and squared with the rest, and thus directed. It is this that renders formulas relating to actions powerful for good or evil. A child has a vague temptation, an inclination he can not account for. Pronounce the formula to him, change the blind impulse into a clear idea, and you give him a new suggestion, which will, perhaps, cause him to fall on the side to which he is inclining. On the other hand, there are formulas and generous suggestions that need only to be pronounced to carry entire masses. It sometimes falls to the man of genius to translate the aspirations of his epoch into ideas; he pronounces the word and a whole people follow. Great moral, religious, and social revolutions occur when feelings, long restrained or hardly recognized, come to be formulated into ideas or words. The way is then opened, the object is revealed with the means, selection takes place, and all the desires are turned at once in the same direction, like a torrent that finds a point where passage is possible.

Conduct depends, therefore, to a large extent on the circle of the ideas which one has received under the influence of experience, social relations, and æsthetic and intellectual cultivation. Every man possesses at the bottom a collection of general notions and maxims which becomes the source of his resolutions and actions, because the aggregate is fused into a sentiment and a habit. The tendency to translate everything into maxims is manifested even in children, because the maxim is a generalization that satisfies the thought. If, then, the circle of ideas proves incomplete at any important point, if false notions or immoral maxims insinuate themselves, we are condemned to incurable weakness or to vice, like a nation whose code contains bad fundamental laws.

The mental faculties, like the physical faculties, develop in the individual into a relation of reciprocal action; but mental activity is more dependent than the other. If you have false ideas on a point of fact or reasoning, it is possible for me in a little while to

enable you to put your finger on your error, or by a demonstration to convince you of it. But it will take months or years to modify a feeling, an inclination, or a habit. Intelligence is, therefore, more flexible, more movable, more progressive, than the rest of our constitution, and for that reason we can act upon it with more facility. Put over the eye of a near-sighted man glasses that will make things visible to him, and he will be obliged to agree that he sees them; show an ignorant man a drop of water in the microscopic field, and he will have to recognize that it is inhabited. Intelligence is to the other faculties of our mind what the eyes are to the organs of our body—a touch at a distance. Hence intellectual activity has a superior power to direct and transform the other kinds of activity. As it discovers new sides in things, it thereby produces a double effect. It excites new feelings and opens new ways to action. Every new idea tends thus to become a sentiment and an impulse, and consequently an idea-force. The intelligence is the great instrument of voluntary selection. It is a shortening means of evolution; it accelerates and accomplishes in a few years selections that might otherwise have required centuries.

If, instead of the individual, we regard the social organism, we shall find that here, too, the diverse activities and the diverse products of civilization are conditioned upon one another, while the products of intelligence and knowledge stimulate or direct all the social functions. Religious, moral, æsthetic, political, and economical creations are determined by the progress made by mankind, whether in the real knowledge of things or in the discovery of new ideals. Instruction is a motor of prime importance in the social mechanism; but on condition that it is brought to bear on truly directive and selective ideas, on those which, by their intimate relation with feeling and will, conspicuously merit the name of idea-forces.

There is, therefore, a medium between prepossessions for and against education. If education does not manifest all the power of which it is capable, it is because it is rarely directed toward its true end and by means adapted to that end. From this results a loss of living forces by the mutual neutralization and disorder of ideas. We sow ideas, as it were, at haphazard in the mind. They germinate in like manner according to the chances of circumstances, of internal predispositions and of the external medium. This is fortuitous selection, as in the domain of material forces. It is not sufficient to instruct; instruction itself must become an education, a process of reflected and methodical selection between ideas that tend to assume reality in acts. We say continually, instruction; other peoples say cultivation, and they are right. The former word leads us to consider the material bearing of what is acquired; the latter the degree of fertility gained by the mind.

Education should not be a simple acquisition of knowledge, but a cultivation of living powers for the purpose of assuring the preference of the highest idea-forces.

After psychological selection, internal to the individual, we have to consider social selection, which takes place between different individuals, or between races or peoples. There are, for any race, physiological and psychological essential conditions of superiority. The race must first of all be physiologically strong, and here only are the ordinary laws of selection applicable, because we are in the domain of life. The sound mind can not exist except in the sound body; all the delicacies of mind are not worth as much to a race as health, vigor, and fertility. Even geniuses can not be born except of a strong race; the intellectual faculties can not be kept up long and advance, except among a vigorous people, and selection can not be efficient and produce the best by nature—a necessary condition of all progress—except in a fruitful and numerous and consequently strong race. Whenever, therefore, we overwork the mind at the expense of the body, we lower the physiological, and therefore the intellectual, level of the race; for generations physiologically weakened will sooner or later suffer the weakening, with their cerebral power, of their mental capacity. The laws of heredity are fatal: to bequeath impoverished organs to children is to prepare for what Pascal would call the stultification of the race at a more or less distant epoch. In the struggle and selection of peoples as recorded in history, when young and perhaps barbarian blood has not been infused with the aged body of a nation, it has fallen steadily, become sterilized, and disappeared or declined, while other peoples were ascending.

Instruction may, we think, lead to two kinds of results: either in dynamic effects—that is, augmentation of cerebral force—or in purely mechanical effects; like scientific and literary routine. In the former case, it acts upon heredity and can produce a hereditary transmission of cerebral force; in the second case, it does not act, or it acts mischievously to the exhaustion of the nervous system. It is intellectual force, not acquired knowledge, that is transmitted by heredity from one generation to another. Hence the criterion which we propose for estimating methods of education and teaching; if there is an augmentation of mental, moral, and æsthetic force, the method is good; if a simple storing up in the memory, the method is bad, for the brain is not a storehouse to be filled, but an organ to be fortified.

The physical and mental inconveniences of overwork may, therefore, very properly occupy attention at this time. Good scholars—those who wish to succeed in an examination or enter certain schools—are the ones who are overworked under our present systems; for the majority of pupils there is no overwork, but

simply almost complete loss of time, years passed in wearing out the benches of the school. Of all that is paraded before their minds they retain nothing but a few vague and confused notions; they attend, as idlers, the excursions of their successive professors through all kinds of sciences, and what is overwork for the others is for them only intellectual vagabondage. If all children were overworked, the race would soon be lost. The idle, says M. Guyau, save it physically. On the other hand, unfortunately, they contribute to keep it in intellectual and moral mediocrity, and to give a false direction to public affairs. The advantages of their idleness might have been preserved without suffering its inconveniences if instead of requiring from all so much knowledge, most of which is useless, we had required strictly necessary knowledge and such moderate number of the finer branches as would lift up the mind while interesting it. In this way we could suppress a large number of the idlers without falling into overwork and without depreciating the race under pretense of elevating it. We need not concern ourselves about the number of things a child knows, but about the way he knows and has learned them, and about the general vigor he derives from his exercises, which alone gives a net profit to the species. How does the earth recreate itself? In the sun, the air, and the rain, by the free action of forces which work upon it incessantly. Quiet on the surface, it works and buds beneath. So with the mind. We should at certain times let Nature act, and not interrupt the unconscious and spontaneous work of organization that is going on in the depth of the brain, as we let the force which is germinating grass and oaks work in the depth of the soil, in solitude.—*Translated for The Popular Science Monthly from the Revue des Deux Mondes.*

Prof. W. Flinders Petrie is quoted as having said that the Egypt of the early monuments was a mere strip a few miles wide of green, amid boundless deserts, and beneath a sky of the greatest brilliancy; a land of extreme contrasts of light and shadow, of life and death. These conditions were reflected in the art. On the one hand was the most massive and overwhelming construction, and on the other, the most delicate and detailed reliefs; on the one hand, the most sublime and solid statuary; on the other, the course and accidents of daily life freely treated; on the one hand, masses of smooth buildings that far outdo the native hills on which they stand, gaunt and bare; and on the other, the vivid and rich coloring in the interiors. In consequence of the climate also Egypt is a land of great simplicity of life, and simplicity is the characteristic of the oldest Egyptian buildings.

From the ages of persons who have died in France during the last thirty-two years, M. Turquan computes that the average length of life in that country has been about thirty-eight years for women, thirty-six years for men, and thirty-seven years for the whole. This is now exceeded, and the average has risen to more than forty years.

EVIL SPIRITS.

By J. H. LONG.

OF all the dark chapters in the history of the world none is more terrible than that which deals with sorcery and demoniacal possession. To-day this belief has almost entirely disappeared in civilized lands: it lingers only in some remote hamlet in "lucky and unlucky days," good and bad signs, and similar harmless idiosyncrasies; although most grown persons can remember that in their childhood certain uncanny individuals were regarded as "witches," just as certain houses were said to be "haunted." But, after all, the belief was only vague and nebulous; while now among even the children ghosts and fairies and witches are regarded with profound skepticism. It is extremely difficult, then, for us to grasp the idea that "for fifteen hundred years it was universally believed that the Bible established in the clearest manner the reality of witchcraft, and that an amount of evidence so varied and so ample as to preclude every possibility of doubt attested its continuance and prevalence. The clergy denounced it with all the emphasis of authority. The legislators of almost every land enacted laws for its punishment. Acute judges, whose lives were spent in sifting evidence, investigated the question on countless occasions, and (as a result) condemned the accused. Nations that were completely separated by position, by interest, by character, were united on this question." More than this. In the city of Trèves alone seven thousand witches were burned. At Toulouse, the seat of the Inquisition, four hundred persons perished in one single execution. Rémy, the judge of Nancy, in France, boasted that he had put to death eight hundred witches. In the little Italian district of Como one thousand perished in one year. The Judge Voss of Fulda burned seven hundred, and said that he hoped to make it one thousand. Benedict Karpzow boasted that he had signed twenty thousand death-warrants for witchcraft. In Sweden in 1690 seventy persons were condemned, and most of them burned. In Great Britain, chiefly in Scotland, in twenty years alone between three and four thousand were put to death. The executions in Paris in a few months were, a contemporary writer says, "almost infinite." Indeed, not to mention imprisonment and torture—torture beyond the wildest flight of modern fancy—the number of persons who perished, chiefly by fire, in Christian Europe and America has been calculated as from one million to nine million. Probably four million is a correct estimate. The annals of the world may be searched through and through, and nothing can be found, I believe, to compare in tragic interest with the chapter on witch-

craft and sorcery. It seems a dreadful thing to say, but I believe it is true: all the heathen persecutions of Christians put together are nothing in comparison with the horrors of the crusade against witches set on foot by members of the Christian Church and by civil rulers in sympathy therewith.

Nor is any single church entirely exempt from this charge. "The Roman Church proclaimed in every way in her power the reality and the continued existence of the crime. She taught, by all her organs, that to spare a witch was a direct insult to the Almighty; and to her ceaseless exertions is to be attributed by far the greatest part of the blood that was shed." Bulls were issued by Pope Innocent VIII, who commissioned the inquisitor Sprenger, whose book was long the standard authority on witchcraft, and who (Sprenger) condemned to death hundreds every year. Bulls were issued also by Pope John II, by Adrian VI, and by many another occupant of the chair of St. Peter. "The universal practice was at service to declare magicians and sorcerers to be excommunicated, and a form of exorcism was inserted in the ritual of the church. . . . Ecclesiastical tribunals condemned thousands to death; and countless bishops exerted all their influence to multiply the victims." The same was the case—although not to so great an extent—with the non-Roman churches. Luther said: "I would have no compassion on these witches: I would burn them all." In England the Reformation was marked by a large increase in the number of persecutions; the prominent theologians, both within and without the established Church, holding firmly to the belief in witchcraft. In Scotland persecution was carried on with peculiar atrocity, while the executions in Puritan Massachusetts form one of the darkest pages in the history of America.

Now, the remarkable thing about witchcraft is that it was believed in not only by the ignorant, but also by the learned; not only by the clergy, but also by the laity. "The defenders of the belief maintained that no historical fact was more clearly attested. . . . The subject was examined in every European land by tribunals which included the acutest lawyers and ecclesiastics of the age, on the scene and at the time of the alleged acts, and with the assistance of innumerable sworn witnesses. The judges had no motive whatever to desire the condemnation of the accused; indeed, they generally had the strongest motive to proceed with caution and deliberation," in view of the awful penalties attached to conviction. Cudworth, one of the most learned theologians the Anglican Church has ever produced; Bacon, one of the acutest lawyers and philosophers of the age; Sir Matthew Hale, chief justice toward the end of the seventeenth century—these are only three from a host of names that might be cited of those who believed in

witchcraft. Sir Matthew Hale lays it down in one of his rulings that it is an undoubted fact that there is such a thing as witchcraft, and that witches ought to be punished. Even Shakespeare shared in the general belief; the witches in Macbeth were to him, not poetic creations, stern realities.

The question is, then: How did this marvelous delusion arise? Three causes, I believe, produced it. 1. To quote Lecky, the historian: "A religion that rests largely on terrorism will engender the belief in witches or magic; for the panic which its teachings create overbalances the faculties of the multitude." This is true: a cruel religion, as Christianity became when it began to rest more and more on the basis of eternal punishment and the wrath of God, will inevitably be haunted by the fear of evil spirits. Therefore it is that the religion of Zoroaster and that of Brahma have been free from the reproach of the persecution of witches and sorcerers. 2. The support from the Bible. Now, there is no doubt at all that the Bible does support the doctrine of evil spirits and witchcraft. And this fact alone is sufficient to destroy the orthodox theory of what Dr. Briggs calls "biblical inerrancy," or freedom from error, for not one person out of one hundred now believes in the reality of possession by evil spirits. There is, I say, no doubt that the Bible does teach this doctrine. "Thou shalt not suffer a witch to live," was the repeated command in the Levitical law; this command was the foundation stone upon which the putting to death of witches rested. We all know the story of the witch of Endor, as told in the twenty-eighth chapter of the First Book of Samuel. Again, the devil afflicted Job in various ways, one way being the sending of a tempest which destroyed Job's sons. Great atmospheric disturbances were always ascribed to Satanic agency, although a nice distinction prevailed: when the destruction was great, it was ascribed directly to Satan; when small, to angels, the word angels being used in a double sense, as messengers of evil and messengers of good. To come to the New Testament. Philip baptizes Simon the sorcerer; and Saul of Tarsus finds in Paphos a certain sorcerer, a false phophet, a Jew named Bar-Jesus.

Whatever view we may take of the Bible, one thing is certain, it abounds with references to evil spirits, the Bible characters believed implicitly in the existence of such spirits, and there is no intimation given that the reign of such evil spirits should cease to exist until the end of all things. We are expressly told, indeed, that "when Christ had called unto him his disciples, he gave them power against unclean spirits to cast them out"; and again: "And these signs shall follow them that believe: in my name shall they cast out devils."

The third cause of the growth of this delusion, and the most

important of all, was the belief that natural phenomena of a hurtful type are the result of the action of evil spirits. As a writer has said: "The phenomena which impress themselves most firmly on the mind of the savage are not those which are manifestly the operation of natural laws and which are productive of beneficial effects. They are, on the contrary, those results which are disastrous and apparently abnormal. Gratitude is less vivid than fear, and the smallest apparent infraction of a natural law produces a deeper impression than the most sublime of its ordinary operations. When, therefore, the more startling and terrible aspects of Nature are presented to his mind, when the more deadly forms of disease or natural convulsion desolate his land, the savage derives from these things an intensely realized perception of diabolical presence. In the darkness of the night, amid the yawning chasms and the wild echoes of the mountain gorge, under the blaze of the comet or the solemn gloom of the eclipse, when famine has blasted his land, when the earthquake and the pestilence have slaughtered their thousands, in every form of disease which refracts and distorts the reason, in all that is strange, portentous, and deadly, he feels and cowers before the supernatural. Completely exposed to all the influences of Nature, and completely ignorant of the chain of sequence that unites its various parts, he lives in continual dread of what he deems the direct and isolated acts of evil spirits."

These three causes, then, combined to produce a belief in witchcraft and Satanic possession.

Let us now trace its growth as far as Christianity is concerned. But to understand this we must go back for a moment to the classic nations among whom Christianity was planted. Magic or sorcery prevailed among the Greeks and Romans, all sects accepting its existence except one sect, that of the Epicureans. It is true, occasional laws were enacted against its practice; in some instances magicians were condemned to death; but the persecution in general was only occasional and was not severe, as magic was regarded as an offense not against God or the gods, but as against the state or the individual. The magician was punished because he injured man, not God. And punishments for injuries to men have always been less severe than punishments for supposed injuries to God. This is the rule of history: punishments for religious offenses have been much greater than those for civil or criminal offenses, the greatness of the crime being measured by the greatness of the being injured. At times it was found that the prognostications of the soothsayers from the flight of birds, the positions of the stars, and other data, tended to produce conspiracies against the emperor; and so punishments were inflicted and repressive laws passed. But, in general, magic and soothsaying

were not regarded with disfavor, the augur, the *haruspex*, and the keeper of the sibyl's books being considered as part of the regular state life of Greece and Rome.

With the advent of Christianity, however, there came a great change. In the matter which we are considering, as in many another, old things had passed away and all things had become new. Before very long after the death of Jesus the Christians were filled with a sense of the awful presence—in fact, the omnipresence—of Satan, which colored their every thought and act. This, added to the idea of eternal punishment—a fate reserved for all those about them who were not of the new faith—gave to the early Christians an intensely realistic sense of evil and an eager readiness to believe in agents of evil of a supernatural order. To their minds the world about them, with its imperial government and especially its non-Christian church ritual, was simply a great object-lesson of Satan's unbridled sway. Everywhere they saw the finger of Beelzebub, the prince of devils. These facts, or rather supposed facts, together with various philosophical systems, such as the system of Plato and that of the Gnostics, made the early Christians believe the earth, the sea, the very air, to be full of evil spirits, the emissaries and agents of Satan. Some of these were the spirits which had rebelled against God and had been hurled "sheer o'er the crystal battlements of heaven." Others were spirits which had gone hither and thither, deluding man in the antediluvian world. Others were heathen deities—Jupiter, Mars, Venus, and so on—all of whom, whether they were of good or of evil report among the Greeks or Romans, were equally evil spirits to the Christians. The spirits who, by these Greeks or Romans, were worshiped under the names of departed heroes—heroes who had achieved so many acts of splendid and philanthropic heroism—these were to the Christians not the real spirits of the dead, but merely devils who had answered the name and assumed the honors of the dead. No relation of life was free from this scourge of evil spirits; they even became the husbands or wives of the Christians themselves. Like the locusts of Pharaoh of old, they were over all the land. It is very hard for us now to imagine what all this means—it seems so laughable, these transformations and artifices and disguises to which the spirits resorted to do their master's bidding! But to these Christians of the second and succeeding centuries it was all stern reality—a matter of eternal life and death.

Now, what followed from all this? Simply that no truce was to be kept with, no mercy shown to, the sorcerer or magician; he it was who could send forth and summon back these spirits; he it was whom they must obey. He was worse, far worse, then, than the evil spirits, for the latter only followed the instincts of

their nature, the former went outside the realm of his human nature to blight by supernatural means the happiness of others and to destroy the peace of the Church. He was therefore held in execration—the enemy of God and man. And after a time—i. e., in the fourth century—the Church obtained secular power, Christianity became the state religion. Then began those awful persecutions that have left an indelible stain upon the Christian name. Constantine, the first Christian emperor, had been reared a pagan. He was inclined, therefore, to be lenient. But Constantius and his successors enacted the severest laws. "All who attempted to foretell the future were emphatically condemned. Magicians who were captured in Rome were to be thrown to the wild beasts, and those who were seized in the provinces to be put to excruciating torments and at last crucified. If they persisted in denying their crime, their flesh was to be torn from their bones with hooks of iron. These fearful penalties were directed against rites which had long been universal; and which, if they were not regarded as among the obligations, were at least among the highest privileges of paganism." Of course, the sufferings produced by these laws may have been exaggerated—the laws are plain, they are still preserved in the official Latin—and of course a large part of the barbarity is to be laid not to the Christian priests or to the better classes of the Christians, but to fanatical mobs and cruel officers. But still two things are plain: the Christians believed in magic and witchcraft as the results of Satanic agency; and, again, they indulged in very severe persecution against suspected persons. These laws, however, proved ineffective; they but showed two things which the world has not quite learned even yet: First, that the mere passing of a law does not change human nature; and, second, that a law that is not sustained very strongly by public opinion is worse than useless. It was thus found impossible by law to suppress the old pagan magic handed down from generation to generation among those who had not become Christians. And so, by a very natural process, there grew up in the Church a counter-system, a sort of rival, the talismans of which were holy water, crucifixes, and other signs and symbols, which became in the succeeding centuries the visible means wherewith the designs of the evil spirits were thwarted.

Gradually paganism grew weaker, but it did not entirely disappear. It merged itself into Christianity, a fact never to lose sight of, for it explains so many apparent mysteries. Just as the Roman Catholic Church to-day in various lands—e. g., in Spanish America—has accepted old heathen customs and festivals, and has changed them into Christian customs and festivals; just as, to take another group of examples, the Druidical May day and Harvest Home, and the Oriental Christmas were adopted by the

Christian Church; so at the time of which I am now speaking—i. e., the sixth century after Christ—the Church adopted, under somewhat changed aspects, many of the beliefs and customs of paganism. The mantle of the ancient faith fell upon the shoulders of the new Church.

In the sixth century the dark ages began, and lasted, roughly speaking, until the beginning of the twelfth century. And dark indeed they were. The old light of classic learning and letters had died away; the new light had not yet dawned. The world was sunk in ignorance and superstition. Evil spirits and sorcery held unquestioned sway. As a writer says: "There had never been a time when the minds of men were more completely molded by supernatural conceptions, or when the sense of Satanic power and presence was more profound and universal. Many thousands of cases of possession, exorcism, miracles, and apparitions of the evil one were recorded which were accepted without the faintest doubt. There was scarcely a great saint who had not on some occasion encountered a visible manifestation of an evil spirit. Sometimes the devil appeared as a grotesque and hideous animal; sometimes as a black man; sometimes as a beautiful woman; sometimes as a priest haranguing in the pulpit; sometimes as an angel of light; sometimes actually in the form of Christ. But the sign of the cross or a few drops of holy water, or the name of Mary, could put him to an ignominious flight. The Gospel of St. John around the neck, a rosary, a relic of Christ or of a saint, any one of the thousand talismans distributed to the faithful, sufficed to baffle the utmost efforts of diabolical malice."

In the twelfth century, however, a new idea appeared, that of the witch proper. Up to this time the idea of a formal compact with the evil one had not taken definite form; but in the twelfth century the conception of a witch, as we now conceive it—that is to say, of a woman who had entered into a deliberate compact with Satan, and who was endowed with the power of working miracles whenever she pleased, and who was transported through the air to pay her homage to the evil one—this idea first appeared. The panic created by this belief advanced at first slowly, but after a time with fearfully accelerated rapidity. Thousands of victims were sometimes burned alive in a few years, and every country of Europe was stricken with the wildest panic. But this very twelfth century has been called the turning point of the European intellect. It began to awaken from its sleep of centuries; foreign lands were visited by travelers; Arabian learning began to permeate Europe; and gradually the people became just a little skeptical. Men learned to doubt, but there was as yet no science, as we understand that word; there was no independent inquiry; men began to doubt—but to doubt was still a crime. The Church

saw the change; and, as was her custom, proceeded to crush the new movement, for rebellion against authority was, in her eyes, the one unpardonable sin. The church teaching began to assume, therefore, a more somber cast; the people became more gloomy and fanatical. This is clearly seen in art, which, before the invention of printing, served as an index to the spirit of the age. For example, up to the end of the tenth century Christ was always represented in painting as having a peaceful, gentle face, and as being engaged in works of mercy. The parable of the Good Shepherd was the favorite subject for the artist. But in the eleventh century this began to change: the painters deal with the death of Christ and with the last judgment. Moreover, Christ's face becomes sterner and mournful. In the twelfth century the change is complete: Christ appears stern and unyielding, like the God of old, whom it repented that he had made man. In this age and the succeeding ages occurred also a succession of physical, social, and political events, all tending to heighten and deepen the gloom which seemed to have settled upon men's minds. Chief among these was that awful scourge, "the Black Death," in all probability the greatest calamity that has ever visited the world, by which in six years twenty-five millions of persons, or one quarter the population of Europe, were swept away. Then began a veritable reign of terrorism: men's minds were paralyzed with dread, uncertain fear. They knew not whither to look; they abandoned themselves to the anguish of despair. Then it was that reappeared the Flagellants, scourging themselves and crying aloud like the prophets of old. Then it was that there wandered from land to land those bands of monks whose bodies were ever bleeding with self-inflicted torture; and then there loomed upon the horizon of a startled world the dread figure of the Inquisition, to whose *autos da fé* had been given the task of crushing out heresy and witchcraft. The trials for witchcraft increased tenfold, and in the fifteenth and the sixteenth century the persecution reached its climax. And truly the aspect which Europe presented at that time was in many ways full of discouragement for those who believed in the ultimate progress of humanity. As a great writer has said: "The Church, which had been all in all to Christendom, was heaving in what seemed the last throes of dissolution. The boundaries of religious thought were all obscured. Conflicting tendencies and passions were raging with a tempestuous violence, . . . and each of the opposing sects proclaimed its distinctive doctrines essential to salvation. Yet over all this chaos there were two great conceptions dominating unchanged. They were the sense of sin and of Satan, and the absolute necessity of a correct dogmatic system to save men from the agonies of hell." This was the state of Europe at the time of the Protest-

ant Reformation, a seething mass of conflicting theological parties and opinions: the old Church, acknowledged even by its defenders to be corrupt, making what seemed to many its death-stand against Protestantism; and Protestantism divided into numberless hostile camps, each only with difficulty united against the common foe.

In these matters of history our minds ought to be especially free from prejudice. For example, the Reformation in the end undoubtedly accomplished a vast amount of good. It fostered among the Protestant churches a spirit of liberty and of free inquiry. It rejected multitudes of superstitions and of worn-out theologic dogmas, it simplified the ritual, it encouraged the reading of the Scriptures, it curtailed the power of the clergy. The good effects of the Reformation were felt also after a time by the Roman Church itself—in greater definiteness of statement, in purified morals, in increased zeal. The Protestant Reformation, in fact, produced the reaction in favor of Roman Catholicism, and ushered in that brilliant era of Roman Catholic missionary effort which still, like an aureole of glory, crowns that ancient Church.

But, although this is undoubtedly true, yet it can not be denied that the immediate effects of the Reformation were not entirely beneficial. It unsettled men's minds, it increased the doubt and uncertainty that weighed down upon men, and it in no wise lightened the gloom in which they groped their way. Moreover, "it was for a time only an exchange of masters. . . . The Protestant believed in his own infallibility quite as firmly as his opponent believed in the infallibility of the Pope. 'Faith' still meant an unreserved acceptance of the opinions of others. As long as such a conception existed a period of religious convulsion was necessarily a period of extreme suffering and terror."

As far, then, as the belief in evil spirits and other agents of Satan is concerned, the Protestant churches stood upon the same ground as that upon which stood the Roman Church. By both sections of the Christian world Satan and his angels were believed to be almost omnipresent. For example, Luther, courageous, full of common sense as he was, tells us that in the cloisters at Wittenberg he used to hear the devil talking to him; in fact, he was so accustomed to this that he naïvely relates that once, upon being awakened by the noise, he looked, and seeing that it was *only* the devil, he went to sleep again. The black stain on the wall of the cell at Wartburg still remains: Luther had thrown an ink-bottle at Satan. He ascribed all his ailments except earache—I do not know why he made an exception of that—to the agency of evil spirits. He tells us that the devil frequently caught travelers and strangled them, and transported persons through the air. He had known Satan to appear in court as an innocent barrister;

and, although Luther was extremely fond of children, yet he advised with great earnestness the family of a boy to throw him into the river because he was possessed with a devil.

And thus, by Protestants as well as by Romanists, witches were tortured and put to death in numbers so vast as to seem to us now utterly incredible, the total number of persons who suffered death in Europe and America being at least four millions. In most cases there was a regular judicial trial; in many cases, however, there were various processes for testing the reality of the witchcraft. These methods resembled the ordeals of the olden time. A favorite method was to throw the accused into water. Then, if she did not drown, that was a sign of possession. For how could she be saved except by Satan's aid? if she did drown, that was not conclusive proof of innocence, because God might have taken the punishment into His own hands. However, at that stage of the case, the trial did not possess any further interest to the accused: it was simply a question of clearing her memory.

I have used the feminine pronouns *she* and *her*. This brings up the question why it was that women were supposed to be almost always the ones who entered into this compact with Satan. The answer is, not so much because of the sensibility of their nervous constitution and their consequent liability to religious monomania, as because, from various causes (for example, that Eve tempted Adam, and that women in olden times held an inferior position as to legal rights), women were considered as inherently more wicked than men. In Roman times Cato had said, "If the world were only free from women, men would not be without the converse of the gods." And Chrysostom, the great father, the golden-mouthed orator, had declared woman to be "a natural temptation, a desirable calamity, a domestic peril, a deadly fascination." When celibacy was introduced into the Church, it was regarded as the highest form of virtue, and theologians exhausted all the resources of their eloquence in describing the iniquity of that sex whose charms had rendered celibacy so rare. So it came to pass that women were believed to be especially prone to enter into compacts with the Evil One. These and hundreds of other matters connected with witchcraft are to be found in the literature of the subject which has come down to us from those far-off days. Endless discussions upon all phases and aspects of the question, the volumes stand now in the great libraries of Europe a monument to human credulity and superstition. All phases and aspects of the question, I have said. For example, there was the point whether a witch felt torture or not. The general belief was that she did feel it, but not so acutely as do others, and that therefore the torture ought to be more severe. Then there was another point, that of self-confession. As all know, a confession of

a crime now is not looked upon as conclusive in law, and the accused is not obliged to confess. But in these trials for witchcraft the whole aim of the court seemed to be to extort a confession. For this object torture was resorted to, with the results that multitudes confessed that they were witches and persisted in their confessions until death relieved them. For the confession meant death, its object not being to spare the accused, but to justify the accuser. As a writer has said, "Madness is always particularly prevalent during great religious and political revolutions"—many therefore confessed through madness. Others, of a timid, doubting mind, made themselves believe that, unknown to themselves, they were witches. While "very often the terrors of the trial, the prospect of the most agonizing of deaths, and the frightful tortures that were applied to the weak frame of an old and feeble woman, overpowered her understanding; her brain reeled beneath the accumulated suffering, the consciousness of innocence disappeared, and the wretched victim went raging to the flames, convinced that she was about to sink forever into perdition."

Another very interesting point discussed at great length in these old books was whether the same body could be in two places at once. That the body might be in one place and the mind in another—this was agreed upon; but whether the body might be in two places—that was a harder question. However, it was decided eventually that this was quite possible, and thereafter the fact that wives were at home with their husbands was not accepted as proof that they were not elsewhere in the same form as witches. Indeed, several early saints had this same gift. St. Ambrose celebrated mass in France and Italy at the same time, and St. Clement is well known to have consecrated a church at Pisa while performing mass at Rome. There is no doubt as to this latter point, for there is blood as a proof upon the altar at Pisa; and if this is not his blood, whose is it? Closely allied to this was what is called "lycanthropy"—i. e., the taking of the form of an animal by Satan or one of his angels. There are some most wonderful stories of transformation to be found in the old records, all of which are very ludicrous to us in this nineteenth century, but when, three hundred years ago, it was a question of the stake here and everlasting fire hereafter, they did not appear so full of humor. A French judge named Boguet devoted himself especially to this branch of witchcraft, wrote a book upon it, and burned multitudes of these lycanthropes, his rule being to strangle other witches first, but to burn these without strangling.

So it came to pass that in the fifteenth and sixteenth centuries the skies of continental Europe were lurid with the flames of burning women, and every market place had its fagot and its stake.

But after a time men's hearts and minds revolted from this hideous slaughter. The first book on the Continent that made an effective attack upon the system was by John Wier, a learned doctor of Cleves. In this book Wier took the ground that, although devils are everywhere about us, and although many persons are possessed with devils, yet there are no such beings as witches, and therefore no one ought to be punished as a witch. He said further that, in his humble opinion, a good many persons supposed to be possessed with devils simply had some disease or other which doctors ought to try to cure. This Dr. Wier was a strange sort of man. He published another book, giving various particulars about the lower regions. He was very exact in his figures; and he ascertained that at that time these regions were ruled by seventy-two princes, and the number of devils was 7,405,926. This book of Wier's brought out the ablest defense ever made of witchcraft—a volume by Bodin, esteemed the most learned of all Frenchmen. This book was not answered; and as far as authorities and figures and biblical texts and judicial rulings go, it can not be answered. Still, it did not stem the rising tide against the belief in witchcraft. Humanity and common sense were asserting their sway, and persecution was doomed. In 1588, the very year of the Armada, Montaigne, the great Frenchman, published the first really skeptical work in the French language. This work ushered in the new treatment, the modern treatment of all such questions. He calmly ignored the mass of authority. "I do not attempt," he said, "to untie the knot: I simply cut it. It is more probable that we are deceived, or that men should tell falsehoods, than that witches should exist. And further, it is setting too high a value on our opinions to roast people if they will not accept these opinions." Montaigne had calmly risen above the mists of superstition into the clear realm of common sense and reason. The last witch in France was burned in 1718. After that there were one or two trials, but the prisoners were acquitted; for "the star of Voltaire had risen above the horizon, and the unsparing ridicule which his followers cast upon every anecdote of witches intimidated those who did not share in the credulity."

In Great Britain the first regular enactment against sorcery was in 1541—i. e., at the beginning of the Reformation—although it had been known before that time. In fact, Joan of Arc had been put to death by the command of the English, although on the soil of France and under the sentence of a French judge. Great Britain, indeed, was not so violently affected by this delusion as was the Continent. This for various reasons, her insular position and greater freedom being the chief. So, although Cranmer, the great churchman, he to whom is so largely owing the

Book of Common Prayer, directed his clergy to seek out witches and sorcerers; and although in the reigns of Henry VIII and Elizabeth there were a few executions, it was not until the time of James I that really severe measures were taken; for James I had been reared in Scotland under Puritan influences, and the Puritans were always especially severe upon witchcraft. The king, in fact, had written a pamphlet on the subject; had presided at the excessively cruel torture of a person who had, it was alleged, caused a storm at sea; and was particularly fond of boasting that Satan considered him, the king, as by far the ablest opponent he (Satan) had as yet encountered in this world. And thus in this reign—the era of Bacon and Coke and Shakespeare—England became, like the Continent, the theater of persecution. But all this was as nothing compared to that carried on in the time of the Commonwealth, when the Puritans held sway. Cromwell himself was not inclined to be cruel; but the whole teaching of Puritanism tended toward the belief in witchcraft and the persecution of witches. It forbade amusements, and had thus a tendency to make the people somber and gloomy. It was intensely earnest: the finger of God and the finger of Satan were seen everywhere. Moreover, it developed especially a taste for the reading of the Old Testament, which abounds with references to supernatural events, and the characteristic of which is severity toward those who are not the Lord's people. And the Puritans were the Lord's people, to whom had gone forth the command "to bind the kings with chains and their nobles with fetters of iron." So, notwithstanding all their many good qualities, the Puritans did not err on the side of leniency toward the unfortunate witches. Indeed, in the county of Suffolk alone sixty persons were hanged in a single year. But the Puritan *régime* came to an end, the Cavaliers returned; and these, being of a more light-hearted although less earnest mind, and also being full of dislike for everything that savored of Puritanism, allowed the laws against witchcraft in great part to remain unenforced. Further, the people were becoming more intelligent and humane, and the Royal Society for the study of science had just been established, and French philosophy became the fashion; and gradually England forgot her witchcraft and her persecution. The last executions were in 1712, in which same year the judge on the bench at another trial charged the jury against the belief in witchcraft.

Scotland, however, was not so fortunate. As a writer has said: "The misery of man, the anger of the Almighty, the fearful power and the continual presence of Satan, the agonies of hell—these were the constant subjects of the preaching. All the most ghastly forms of human suffering were accumulated as faint images of the eternal doom of the immense majority of mankind.

Countless miracles were represented as taking place within the land, but they were almost always miracles of terror. Disease, storm, famine, every awful calamity that fell upon mankind or blasted the produce of the soil was attributed to the direct intervention of spirits; and Satan himself is represented as constantly appearing in a visible form upon the earth. . . . Such teachings necessarily created the superstition of witchcraft; it was the reflection by a diseased imagination of the popular theology. Moreover, it was produced by the teaching of the clergy, and was everywhere fostered by their persecution." Thus it is that the annals of Puritanism and Calvinism in Scotland are red with tales of the thumbscrew and the boot and the witches' bridle and the axe and the stake. While the clergy of the Established Church in England were comparatively free from any desire to persecute, while torture was only very rarely resorted to; while, in a word, persecution was carried on by the people in a very half-hearted way, in Scotland there were being enacted, at the express command of the clergy, scenes which rivaled those in Roman Catholic Europe. "And yet these Presbyterian clergymen of Scotland were men who had often shown, in the most trying circumstances, the highest and most heroic virtues. They were men whose courage had never flinched when persecution was raging; men who had never paltered with their conscience to attain the favors of a king; men whose self-devotion and zeal in their sacred calling had seldom been surpassed; men who in all the private relations of life were doubtless amiable and affectionate. They were but illustrations of the great truth that when men have come to regard a certain class of their fellow-creatures as doomed by the Almighty to eternal and excruciating agonies, and when their theology directs their minds with intense and realizing earnestness to the contemplation of such agonies, the result will be an indifference to the suffering of those whom they deem the enemies of their God, as absolute as it is perhaps possible for human nature to attain."

But Scotland also became sick of blood and fire. The last execution for witchcraft was held in 1722, although in 1773 the divines of the associated Presbytery passed a resolution declaring their belief in witchcraft and deploring the general skepticism.

It is not necessary to enter upon the history of witchcraft in America. Its details are known to all. Nothing so clearly brings to one's mind the reality of this delusion and the persecution it entailed as the court papers, preserved as they are in the archives of Essex County, Massachusetts. As one looks upon those faded records and reads of question and cross-question, of plea for mercy and stern refusal, he can again see those awful trials; he

can once more behold the dread procession wending its way amid jeers and scoffs and pitiless execration to what is still "The Gallows-hill of Salem."

It is, in fact, impossible to exaggerate the sufferings produced throughout Christendom by this superstition. "It is probable that no class of victims endured sufferings so unalloyed and so intense. Not for them the wild fanaticism that nerves the soul against danger and almost steels the body against torments. Not for them the assurance of a glorious eternity that has made the martyr look with exultation upon the rising flame as on Elijah's chariot that is to bear his soul to heaven. Not for them the solace of lamenting friends or the consciousness that their memories would be cherished and honored by posterity. They died alone, hated and unpitied; their very kinsmen shrank from them as tainted and accursed. The superstitions they had imbibed in childhood, blending with the illusions of age and with the horrors of their position, persuaded them in many cases that they were indeed the bond-slaves of Satan, and were about to exchange their torments on earth for an agony that was as excruciating, but was eternal." And it is wonderful how long this delusion lasted after judicial punishment in most countries had ceased. In Spain a witch was burned in 1780; in 1807 a beggar was tortured and burned in France; in 1850, in France, a man and wife tortured and killed a woman suspected of witchcraft, and it was with some difficulty that they were punished at all, on account of the lingering belief in sorcery; in 1860 a woman was burned in Mexico, as was the case with several persons in 1874; in 1879 and 1880 witches were burned in Russia; while up to that date, and possibly later, regular judicial trials were held in Austria and Prussia. It is needless to say that almost up to the present, even in England and the United States, persons have been attacked by mobs and private individuals, because it was believed that they were in league with Satan.

But, roughly speaking, this superstition has entirely disappeared; and it has disappeared, not so much through religion as through enlightenment and rationalism. The crushing of this hydra-headed monster of superstition is one small part of the debt the world owes to science.

Some drawings recently found by Herr J. Naue at a prehistoric station near Schaffhausen, Germany, comprise, on one side of a piece of limestone, a horse, a foal, and a reindeer, and on the other side several horses. The style is not so fine as that of the Thayngen drawings of France, but the pictures, according to the finder, display a power of keen observation. Herr Naue also remarks that it was more difficult to work on stone than on a bone still fresh.

STRUCTURAL PLAN OF THE HUMAN BRAIN.

By Prof. CHARLES SEDGWICK MINOT,
OF THE HARVARD MEDICAL SCHOOL.

THE human brain is the most complicated organ known, and although its anatomy has been the object of innumerable investigations, often by observers of the highest ability, we are still far from understanding its organization. Within recent years, however, embryologists have turned to the study of the development of the brain, and have succeeded in elucidating many of the obscure features. Here, as in so many other cases, embryology has furnished the master-key to unlock the mystery of the adult anatomy. The series of conceptions which we have derived from our present knowledge of the development of the brain are so clearly established that I regard them as impregnable. They are so far in advance of all previous achievements in the study of the brain that they may be called almost revolutionary, and they are of so fundamental a character that the entire anatomy of the brain and the entire physiology of the brain must be recast to agree with our embryological results.

The present article is an attempt to summarize, as simply as possible, the principal conclusions of recent researches on the nervous system.

Physiologists have long been accustomed to divide nerve fibers into two classes: efferent, or those which carry out impulses; and afferent, or those which carry in nerve impulses to the nervous system. Not infrequently the less accurate terms sensory and motor are used as synonymous with afferent and efferent respectively. The nerves are bundles of nerve fibers, and each nerve is supposed to have typically two roots—one sensory, by which all the sensory fibers enter, and the other motor, by which all the efferent fibers leave, the nervous system. It was supposed that every nerve fiber was connected with a nerve cell in the central nervous system, and that the nerve fibers grew out from the central nervous system. It has long been known that various nerves have thickenings at certain points; the thickenings are the so-called ganglia and they contain nerve cells. The cells in these ganglia were supposed to have migrated from the central parts along the nerves.

The preceding recapitulation of familiar elementary facts will serve to emphasize the following new conclusions: 1. The nervous system consists of two parts, which differ so markedly in their origin and differentiation that it would be hardly an exaggeration to say that there are two nervous systems, for the original duality is never obliterated. The two parts I shall term the

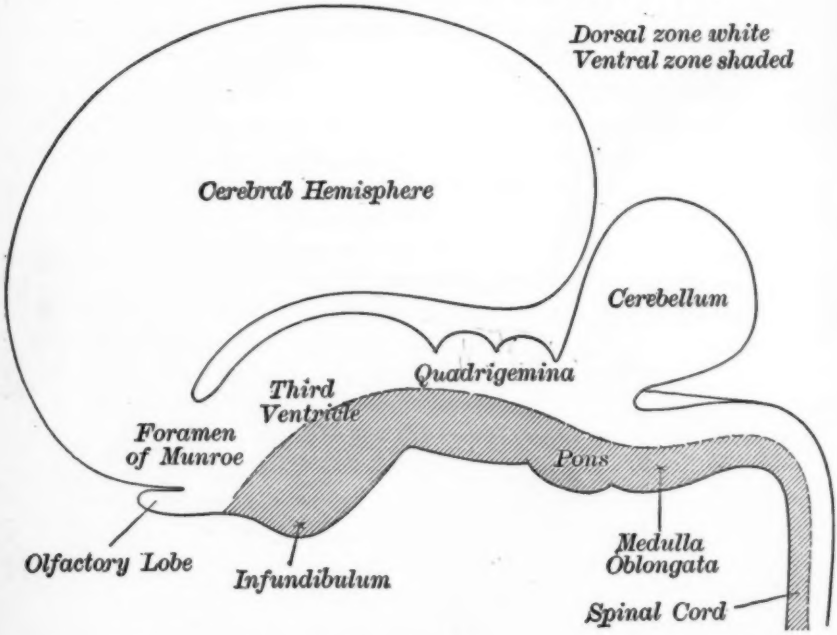
medullary and the *ganglionic* respectively. Each part has its special typical cells and nerve fibers. It is further probable that there is still a third class of nerve fibers—namely, those connected with the sensory apparatus of the special sense cells. 2. There are *three* sets of nerve roots—namely, the true *dorsal* roots, which are formed solely by ganglionic nerve fibers; and the *lateral* and the *ventral* roots, which are formed solely of medullary nerve fibers; the lateral roots have been hitherto generally confused with the dorsal roots; they have been traced heretofore only in the brain and in the cervical nerves, but I consider it more than possible that the posterior roots of the spinal nerves will be found to represent both dorsal and lateral roots. 3. Nerve fibers grow out from a cell and the end of each fiber branches; but, so far as observed, none of the branches become materially continuous, either with other nerves or nerve cells or with any other cells or other protoplasmatic structures. 4. The entire brain and spinal cord is divided into four principal longitudinal divisions, which I have named after their discoverer the *zones of His.* The zones are in pairs—that is to say, on each side there is a *dorsal* (i. e., in the spinal cord "posterior") and a *ventral* (i. e., in the spinal cord "anterior") zone. These zones are of fundamental importance, because all the fibers which belong to the ganglionic portion of the nervous system ramify in the dorsal zone, while all the fibers belonging to the medullary portion leave the spinal cord (or brain) through the ventral zone. Both zones persist throughout life, and preserve their fundamental relations to the two kinds of nerve fibers.

Let us now attempt to acquire fuller and more exact conceptions in regard to the four discoveries above enumerated. We may hope to do this without entering into technical details and with the use only of terms readily understood. At the same time we shall learn wherein the significance of the four discoveries lies.

THE FIRST DISCOVERY.—The division of the nervous system into a medullary portion and a ganglionic portion has to be explained. The division has long been a familiar fact to anatomists, but its true character and fundamental significance have been known a short time only, because it is owing to very recent embryological discoveries that the independent development of the ganglionic portion has been elucidated. The existence of the ganglia has long been known, but their development independently of the rest of the nervous system is a new conception. Their independence is, of course, not absolute but relative, for every part of the body develops in intimate relations with, and in dependence upon, the neighboring parts.

By the medullary portion we understand the brain proper plus the spinal cord or marrow and the nerve fibers, which grow

out from the brain and spinal cord. The brain and spinal cord, since the days of the celebrated investigations of Karl Ernst von Baer, have been identified as modifications of a single long tube, the so-called medullary tube of embryology. This tube, as the embryo advances, gradually increases in complexity, especially in the region of the head, until it is converted into the brain and spinal cord. The complications which occur may be conveniently grouped under four heads—namely, the flexures, the widening of the cavity or its obliteration in a way varying for each region, changes in the thickness of walls, and lastly an extreme differentiation of the microscopic organization. Without detailed explanation it may be readily conceived that by the varying co-



operation of these factors great differences arise in the sundry parts of the originally simple medullary tube. On the other hand, in the most fundamental characteristic, the production of nerve fibers, the same principle governs brain and spinal cord alike. There appear very early certain cells, which soon become recognizable as young nerve cells (neuroblasts) because of their size and pointed shape; the pointed end now elongates into a very delicate thread, the nerve fiber, which is at first very short but rapidly lengthens almost like a growing root; the growing fiber takes its course for a certain distance, varying according to circumstances, within the wall of the medullary tube, but ultimately passes outside the tube into the neighboring tissues together with other nerve fibers of similar origin. It must be added that some

of the nerve fibers are of the Golgi type—that is to say, they end as well as begin within the central nervous system. The bundle of nerve fibers which pass out together constitute a nerve, or, to speak more correctly, a nerve root. So far as yet observed no exception occurs; therefore we may safely assert that every nerve cell of the brain or spinal cord produces one nerve fiber and only one, and this fiber grows out from the nervous system into the tissues of the body. The fiber is single at its origin, but since we always find the peripheral fibers branching, we may add that the fiber is multiple at its termination. The nerve cells acquire also other secondary branches—the so-called protoplasmatic processes or dendrites—which grow out from the cells, but are not nerve fibers and are confined in their growth to the nervous tissue itself. The secondary branches present highly characteristic variations in the different regions of the brain, as described in the text-books.

By the ganglionic portion we now understand the nerve cells which lie in little groups outside of the medullary tube. These cells produce fibers, which grow in two directions—on the one side into the brain or spinal cord, on the other away from the brain and cord into other tissues and organs. It has been observed that the ganglionic nerve cells elongate and become spindle-shaped; each pointed end of the cell grows out into a nerve fiber; as the nerve cell connects the two fibers, we may describe the actual condition accurately as resulting in a single nerve fiber, which has a nerve cell interpolated in its course. Each group of nerve cells forms a bundle of nerve fibers, which constitute the posterior (or so-called dorsal or sensory) root of the anatomists. If we follow a ganglionic fiber into the spinal cord or brain, we find that it forms two branches, as first recorded by Ramon y Cajal, a distinguished Spanish histologist; of these two branches, one runs upward, or in the brain forward, and the other runs downward, or in the brain backward; each fork gives off secondary branches (collaterals), that ramify still further, and are all situated within the central nervous system proper. If we study the termination of the ganglionic fiber at its other end—that is to say, in the tissues or organs—we find that there also there occur several ramifications. These fibers, like the medullary fibers, have each a single origin, but, unlike the medullary fibers, have *two* sets of multiple terminations. Although both the peripheral and central terminations have been carefully studied, they have never been found connected with other structures or cells, but only to be in contact with them.

The true history of the ganglia and their nerve fibers has been elucidated chiefly through the masterly researches of Wilhelm His, Professor of Anatomy at Leipsic, who is the recognized highest living authority on the development of man. This addition

to our knowledge of the nervous system is perhaps the most important which has been made during the last generation. It teaches us that the nervous system comprises two sets of nerve cells and fibers, which differ not only in their situation, but also in their development and distribution. We are already in a position to say that the entire physiology of the brain must henceforth be based upon this discovery of the independence of the ganglionic system, because the same laws can not apply without change to structures so differently organized as are the two portions which we have briefly characterized, and there can be no doubt that the functions are as fundamentally divergent as is the organization. It is, however, still too soon for cerebral physiology to have remodeled itself, but that remodeling must follow, since physiology always bases itself on the anatomical facts.

Besides the two classes of nerve fibers, the medullary and ganglionic, we may have to add a third. In the organs of special sense (sight, hearing, smell, and taste) there are found the peculiar sensory cells, which all present two special features: First, they have characteristic modifications of cellular structure, by which they are adapted to receive sensory impressions; second, they are each united with a single nerve fiber. It has long been, and indeed still is, the prevalent theory that the nerve fiber arose from the brain, grew to the cell, and united with it. Merkel was, I think, the first to suggest that the sensory cells are also true nerve cells, the nerve fiber springing from them and growing to the brain. This view has been brought into fresh prominence by the discovery made by Michael von Lenhossék that Merkel's supposition is true in the case of the earthworm, which has cells scattered in its skin, each cell giving rise to a nerve fiber, which must arise from the sensory cell since it is connected with no other cell, although it enters the central nervous system and there ramifies.

THE SECOND DISCOVERY.—For the recognition of the three sets of nerve roots also we are indebted to the researches of His, published in 1888. Previous to that time anatomists recognized two roots only—the posterior or dorsal roots, and the anterior or ventral roots. In the spinal cord it was easy to maintain Bell's law, that the posterior roots are sensory; the anterior, motor or efferent. The cephalic nerves, however, could not be brought into accord with this law, because of numerous difficulties, of which one may be mentioned as an example. The nerve called the facial was found physiologically to be both sensory and motor, and yet was shown embryologically to correspond to a posterior root. Through His we learned that the cephalic nerves corresponding to the posterior roots have in reality compound roots, being double. In fact, the nerves of the class referred to consist each of a bundle of ganglionic fibers which enter the brain and branch in its dor-

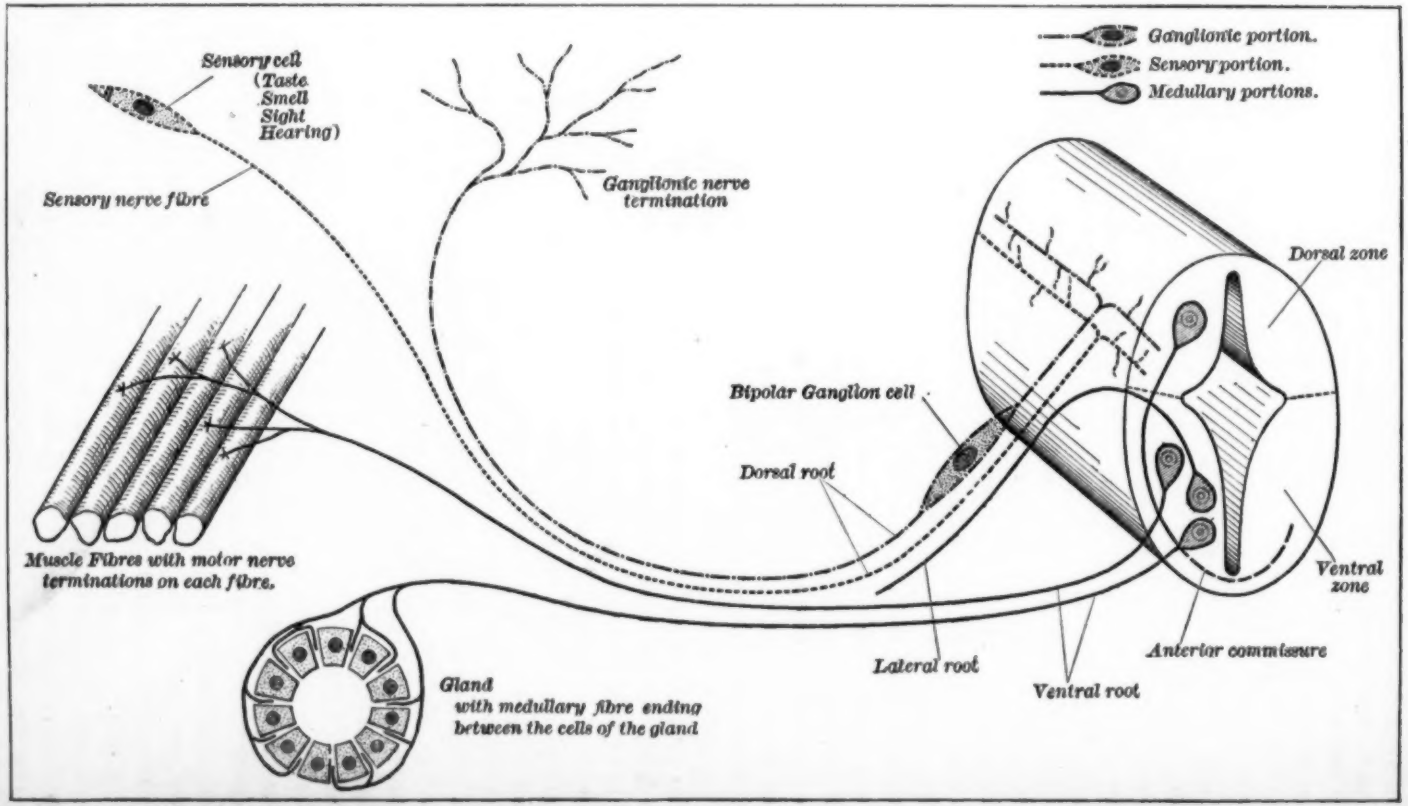


DIAGRAM TO SHOW THE ORIGIN AND TERMINATIONS OF NERVE FIBRES.

sal regions, and of a bundle of medullary fibers, which arise in the ventral portions of the brain and pass out from it immediately below the entrance of the ganglionic fibers. Evidently there are two roots, which, from their close juxtaposition, have been hitherto unrecognized; the ganglionic bundle is the *true dorsal root*, the medullary bundle the *lateral root*. If, now, we modify Bell's law by saying that all medullary fibers are efferent or motor, and all ganglionic fibers afferent or sensory, we can understand the double function of the facial nerves and of the other nerves resembling it—to wit, the trigeminal, glosso-pharyngeal, and vagus.

The recognition of the lateral root as distinct from, though joined with, the dorsal sensory root, removes many obscurities in the anatomy of the nervous system. We know that lateral roots are not confined to the nerves of the head, but they also occur in the upper cervical nerves, and I regard it as highly probable that with the progress of research they will be found sharing in the formation of other spinal nerves. Should this expectation be fulfilled, the long-established conception of the posterior roots as purely sensory will have to be modified, although it has reigned for three quarters of a century as one of the fundamental conceptions of physiology.

THE THIRD DISCOVERY.—The third discovery is that neither the nerve cells nor nerve fibers are directly continuous either with other nerve cells or with the cells or structures of other tissues and organs. Every nerve cell, together with its fiber, is an entity, and is not organically continuous with anything else. It is certainly premature to affirm this discovery positively, for we can say at present only that the consensus of the best opinion, of such men, for instance, as His and Kölliker, is in favor of the conception that every nerve cell plus its nerve fiber is an isolated element. Until recently the hypothesis was received with favor that the cells of brain and spinal cord were connected by threads of protoplasm, or, to speak more precisely, by branches of the processes of the cells; according to this hypothesis, there would be a direct protoplasmatic continuity between the different parts of the nervous system, and therefore a nerve impulse brought by a sensory fiber to the brain could be conceived as traveling along an uninterrupted pathway of living matter until it produced its final action. In many text-books of physiology there are diagrams to illustrate the theory of a continuous pathway. It is evident that if there is no such connection between nerve cells as assumed, then we must radically alter our conceptions of the process of the transmission of nerve force through the brain.

In the question before us, Camillo Golgi and his followers must lead the way. Golgi, whom the world will probably rank

among men of genius, has unquestionably done more than any other man living to enlarge our knowledge of the minute structure of the brain, for we owe to him, besides invaluable researches, the invention of an entirely novel method of study, by which a few of the cells of the brain are marked out with the utmost distinctness by a deep deposit of color, while most of the cells and tissues of the brain are left translucent and lightly tinged. The finest ramifications of these cells can be followed in such preparations under the microscope, yet they have never been proved to unite with the ramifications of other cells. Another method is that which consists in treatment by chloride of gold, as long employed in histology for tracing the finest thread of nervous substance, yet with this also it has hitherto been impossible to demonstrate any actual continuity of cell with cell. There are, however, certain authorities who still uphold the older view. Thus Adam Sedgwick, guided by certain general theoretical considerations as to the laws of cell connection, expects to find the continuity hypothesis re-established. Recently Prof. Dogiel, of the Siberian University at Tomsk, has published an article in Russian, in which he apparently seeks to verify the same hypothesis by actual observation, but unfortunately his results are not yet fully accessible to me. The settling of the problem is beset with the greatest difficulties.

The physiological consequences of the theory of non-continuity reach very far. Thus, if the sensory fibers simply branch within the brain, then there must occur a leap from those fibers to the cells which are to send out the reflex response to the sensation. So in other cases there must be a leap from one cell to another. Perhaps the leap or transfer is comparable to an electric induction. But it is obviously useless to ramble into sheer speculation.

THE FOURTH DISCOVERY.—The zones of His were vaguely recognized by Löwe, but to His belongs the honor of having first clearly recognized them and established their morphological importance. There are four zones of His—two on each side; they run the entire length of the brain and spinal cord, except that in the partially aborted end of the latter the zones are imperfectly developed. Each zone is a thickening of the wall of the medullary tube. We distinguish the dorsal and ventral zones. The dorsal zone was termed by His the *Flügelplatte* (wing plate) and the ventral zone the *Grundplatte* (basilar plate), but the new names proposed appear to me preferable. At an early stage of development the two zones are very clearly marked off from one another; but after a more advanced stage is reached, although they preserve their characteristic differences, their delimitation is far less conspicuous. They persist throughout life, and can be identified in the adult. Thus, for example, in the cerebral region proper, or,

as commonly termed, the region of the third ventricle, is a groove known as the sulcus of Munro, which runs from the opening which is termed the foramen of Munro, along the lateral wall of the ventricle, backward to the narrow continuation of the ventricle which has received the fanciful name of the aqueduct of Sylvius. This groove, the exact position of which I have thus indicated for the sake of possible anatomical readers, is the boundary between the dorsal and ventral zones. The superficial character of our previous knowledge of the brain is emphasized by the fact that the sulcus of Munro is usually not mentioned or figured in anatomical text-books, and yet we can say now that it is the most important landmark to be found in the part of the brain in which it occurs. It will suffice to give one other example: In the spinal cord the structure known by the name of the posterior fissure—a singular misnomer, since it is not a fissure—arises by the growing together of the two dorsal zones; a line drawn from the bottom of the so-called posterior fissure to the entrance of the posterior nerve roots would represent approximately the boundary between the dorsal and ventral zones. These two examples can, of course, be clear only to anatomists, but they demonstrate the permanency of the zonal divisions.

We have already learned that the fibers which arise from the nerve cells of the ganglia outside the nervous system proper enter the dorsal zone of His and there fork, the forks running longitudinally within the zone but in opposite directions. Gradually the number of fibers running in the zone increases until they form a fibrous tract of considerable size. The tract is originally situated next the outer surface of the nervous system; in the case of the spinal cord it remains permanently upon the outside, and therefore, as the nerve fibers ultimately become white in color, there is the so-called "white substance" covering the outer portion of the dorsal zone of the spinal cord, and it is this covering, which is known anatomically as the posterior columns,* and which overlies all the medullary nerve cells that form part of the interior or "gray matter." In the brain also there enter several nerves, the ganglionic fibers which are distributed in precisely the same way as those just described—that is, they produce a superficial layer in the dorsal zone; they may be seen in this position during early stages in the part of the brain (medulla oblongata) adjoining the spinal cord. By secondary processes there follows a spreading of the nervous tissues over the outside of this white matter. We then have a white matter buried and isolated, but it remains, what it was primitively, the direct continuation of the superficial

* Including the postero-lateral columns, the columns of Burdach, and perhaps also the columns of Gol.

layer of the spinal cord. The bundle of nerve fibers is known as the solitary tract. Although the relations are complicated and not easily rendered clear, I hope enough has been said to demonstrate that the dorsal zone always remains what it is at first—the zone into which the ganglionic fibers enter and in which they chiefly ramify.

As every one knows, the two largest divisions or parts of the human brain are the cerebrum or hemispheres and the cerebellum. These, we have now learned, are both structures developed exclusively from the dorsal zones of His, and have therefore a very different morphological value from what has hitherto been assumed—not being modifications of the whole brain, but only local developments of the dorsal half of the brain. Just as primitively the medullary fibers which arise in the dorsal zone pass into the ventral zone, so in the specialized cerebral hemispheres and in the cerebellum there arise very numerous nerve fibers, but these still obey the primal law and take their courses into the portions of the brain representing the ventral zones, and thence the fibers are distributed to their various destinations. Until the relations of the zones to the nerve fibers, on the one hand, and to the hemispheres and cerebellum on the other, had been embryologically determined, it could not be known that the course of the cerebral and cerebellar fibers is in accordance with a fundamental law of nervous organization. We can foresee, though somewhat vaguely, that essential physiological deductions will follow the application of the law to the study of the functions of the brain.

The relations of the zones in the entire brain are indicated by the diagram on page 374, which scarcely calls for comment, since it sufficiently explains itself. I need only add that the position of the dividing line of the zones in the region of the corpora quadrigemina is somewhat uncertain. In the embryo this region is known as the mid-brain, and shows the primary division very clearly; but as the further development has not been worked out properly yet, we can not decide positively as to the exact demarcation of the zones in the adult.*

The ventral zone of the brain may be defined, as we have already learned, as the territory of the medullary fibers, for it furnishes the pathway for those fibers to collect in bundles, which may either form nerve roots (ventral or lateral), or may cross, as so-called commissural fibers, from one side to the other in order to establish the nervous connection between the two halves of the

* I am led to suppose that the dorsal zones of the mid-brain unite, but that the ventral zones do not, and that therefore the aqueduct of Sylvius lies entirely between the ventral zones, the dorsal portion of the original cavity in that region of the brain being obliterated. It is very possible that this supposition is incorrect.

brain or spinal cord. Most all the nerve fibers produced within the brain enter the ventral territory, for in this territory we observe not only the fibers which it obviously must include—namely, those which are produced by the nerve cells of the ventral zone—but also the nerve fibers produced by the nerve cells of the dorsal zone. So far as at present known, the nerve cells of the dorsal zone all produce nerve fibers, but these fibers always pass into the ventral division of the nervous system. These fibers of dorsal origin are the chief, perhaps the only ones, which are commissural—that is to say, which pass to the opposite side of the brain; others of these fibers take longitudinal courses within the ventral zone; while still others participate in the formation of the nearest ventral (or anterior) nerve roots. If, therefore, we assume that the sensory nerve impulses are carried into the dorsal zone and there transferred to the medullary nerve cells, we must conclude that from those cells the impulse may be sent along medullary fibers either into the opposite side, or up and down the ventral zone, or into a neighboring nerve root. The center of divergence is the dorsal zone, but the actual divergence of the fibers takes place in the ventral zone.

Although the ventral zone receives medullary fibers and itself produces nerve fibers, it sends, so far as yet observed, no fiber into the dorsal zone, but all the fibers which leave the ventral zone form nerve roots and leave the nervous system altogether. These roots, as we have already learned, are in two sets—the lateral and ventral.

SUMMARY.—The numerous facts which we have marshaled in hasty review so greatly widen our knowledge of the nervous system that it is important to render them as clear as possible. If what has been presented be critically considered, it will be found that what we have gained is an enormous accession of knowledge in regard to the nature, origin, distribution, and connections of nerve fibers. In order to make the typical variations of nerve fibers as evident as possible, I have constructed the accompanying diagram, which is, I think, correct for all which it attempts to give. We notice: *First*, that the central nervous system is a medullary *tube*, the walls of which form two dorsal zones and two ventral zones. *Second*, that every nerve fiber arises from a single cell only, and is nowhere united with any other cell. *Third*, that every nerve fiber has a branching termination. *Fourth*, there are three kinds of nerve fibers: (1) Medullary, which arise from the nerve cells of the central nervous system proper; of the medullary fibers three kinds are distinguished—namely, those which pass out to form the ventral root, those which pass out to form the lateral root, and those which pass as commissures to the opposite side of the tube; there are also medullary fibers which run

lengthwise of the nervous system, but these are not represented in the diagram; second, ganglionic fibers, which run from the bipolar ganglionic nerve cells in two directions, and have two terminations, one branching within the medullary tube, the other branching to form peripheral sense organs; third, peripheral sensory fibers, which spring from the nerve-sense cells; that fibers of such origin exist is well known, but that they enter the central nervous system and there ramify, as here depicted, has as yet been actually demonstrated only in the earthworm. *Fifth*, that all the ganglionic and peripheral sensory fibers enter the dorsal zone only, while all the medullary fibers make their exit from the ventral zone only.

If we can reason from the structure, we must conclude that all the complicated functions of the brain depend upon four primary sets of functions—*namely*, 1, 2, and 3, the functions of the three classes of nerve cells, together with their connected fibers; and 4, the function of transferring nerve impulse from one fiber to another. Until physiologists and psychologists shall have learned to differentiate the four sets of functions, and have invented successful means for their separate investigation, cerebral physiology is, in my opinion, likely to remain, what it has so long been, a science of unsolved problems.

THE AMERICAN WOMAN.

By M. C. DE VARIGNY.

IN essential characteristics—by tradition, by nature, and by education—the American woman is the direct antithesis of the woman of the East, of her of whom the Hitopadésa says, "A woman should be under the watch of her father during infancy, of her husband in middle age, of her sons in old age, and never independent." In the United States she is under the watch of no one, but under the protection of all.

If by the aid of historical documents we reconstitute the colonial situation in America as it was in the beginning, we find the man absorbed in daily work out of doors and the woman in her tasks within, and equality of the sexes resulting from equality of burdens and responsibilities; then, as prosperity increases, the task of the woman diminishes while the burden of the man remains the same, and the leisure of the former contrasts with the severe labor of the other. Woman's intelligence develops and extends; man's becomes concentrated and specialized, his education is limited, and remunerative labor awaits him and takes him away early in life. She, the equal and companion of man at the begin-

ning, becomes gradually superior to him, by the leisure which he creates for her and the use she makes of it, in intellectual cultivation, in the variety and extent of her knowledge, and by the lead which she is able to take and keep. She is the resultant of a concurrence of circumstances which have not yet been found united in a like degree anywhere else, and which have all contributed to make her a superior type of the race. In her are combined and fused the characteristic traits which, more specialized in the man, appear accentuated, magnified, exaggerated, as well by the free play of natural instincts as by the necessity of furnishing himself with arms in the struggle for existence and of demanding from them the maximum of force and of practical utility. In the woman these characteristics persist, but they are tempered and held in; she smooths their angles and polishes their facets, and of a dull pebble makes a precious stone. The constituent parts remain the same, but a judicious cutting sets the luster and beauty of the stone in clear relief.

Those who find more to blame than to approve in the American young woman, who are shocked at the freedom of her ways, at her independence, at her scorn of social conventions, at her luxurious tastes and her fondness for admiration, have often made those traits the text of their accusations against the democratic institutions of the United States. According to their reasoning, the result could not be otherwise, given the same premises as a point of departure, namely, the customary association of young women and young men, equality of the sexes raised to an axiom, abdication of parental dictatorship, independence of children, and freedom of matrimonial choice. The eccentricities noticed by them are, in their view, the inevitable consequences of a democracy hostile by instinct to the principle of authority, endeavoring to reduce it everywhere to its minimum of action and control, extolling equality with an apostolic zeal and practicing it with the fervor of a neophyte. And now these pretended apostles of equality, these self-styled levelers of privilege, have ended with re-establishing inequality with the advantage on the woman's side, with making her the eminently privileged person, and, reversing the Asiatic conception, of elevating her into a despot and converting the man into a subject. It seems to us, however, that the influence of political institutions on social habits has been very much exaggerated. Unstable and mobile, the former change at the caprice or the passions or the necessities of the moment. Not so with that aggregation of usages and customs which rests upon uninterrupted traditions, upon a long transmission. They undergo modification, but slowly; they are the results of the experience of centuries, and never proceed by jumps in their evolution. More of the fundamentally primitive than is usually believed re-

mains common to the Americans and the English in their relations to women; and the large place given to woman in the United States, and the greater independence she enjoys, flow as much from the change of medium as from the advanced intellectual position which she was able to take at the beginning and has long held.

But as the United States grows and becomes more refined, the difference between the sexes in this respect is diminishing. Yet while man has to a large extent recovered possession of the vantage-ground in mental cultivation occupied by woman, and while his stronger faculties, more robust organization, and more sustained will give him the superiority everywhere else, there is a social domain from which he could not and would not dispossess her—a domain hers by tradition and by concessions which he has made and she has accepted and extended. At this point becomes manifest the contrast between the Anglo-Saxon and the Latin races, the antithesis between the conception of the East and that of the West, the two poles of which are Asia and the United States, while its mean term is found in central and southern Europe. To these two poles correspond, in effect, a maximum and a minimum of human personality. This personality is nowhere so intense as in the United States, and nowhere less so than in the extreme East. England transmitted to the United States, with that basis of personality peculiar to the English race and more accentuated there than anywhere else in Europe, that respect for individuality which made itself manifest at an early period in British laws and institutions.

Cantoned in her family and social domain, the American woman has till this time made only rare and timid incursions into the field of politics. But in the field in which she usually moves, we are struck, on a close examination of the various phases and details of life in the United States, with the important place she occupies. This is true to a higher degree in modest conditions, in the agricultural districts, in the farms and settlements and in populations of working people, than in the large cities. Not that these, too, do not contain curious types for study, essentially original, and tending in a high degree to reconcile the exigencies of the external features of modern life with lofty aspirations and an active philanthropy.

Given, as the points of departure for woman's position in the United States, equality with man, intellectual and social predominance, with the charms of her sex refined and developed by natural selection, by unions between young women free to choose and a race of colonists energetic, vigorous, deeply imbued with religious convictions, and respecting the conjugal bond, woman must necessarily appear, at any given moment, as the definite ex-

pression, the superior type of the race and the medium. She is to-day, what the American exhibits her in Europe with a legitimate pride, the most finished work of the country's two centuries of civilization.

It seems as if on the American soil, essentially democratic, Nature showed herself, in what concerns woman, more aristocratic than elsewhere, and that the genius of natural selection was working perpetually for the advancement of its elect. Of all these gifts which it has lavished upon her, one of the most characteristic is certainly adaptability. Few women in Europe possess in the same degree as the American woman the faculty of identifying themselves with their medium, of changing country, climate, and surroundings with so wonderful suppleness. More perfectly than others, she accommodates herself to circumstances, while she preserves her individuality in a strange surrounding.

Wherever we meet the American women—and we meet her everywhere, in the ranks of the English peerage and of the highest European aristocracy, as well as in more modest conditions—we are struck with that marvelous adaptability in which wise men see the sign of the superiority of a race or of a species. It is revealed notably by that good humor with which she accepts the numerous petty annoyances that every change of medium implies and which put the best characters on trial. She submits to them without effort, and criticises them without bitterness; she is, further, prepared for them by her education, and does not expect to find everything easy. Then the necessity of manual labor does not seem to her like a degrading condition; at most only one or two generations separate her from the time when her grandmother kneaded the family bread in the primitive settlements. These stories are familiar to her, and the lessons deduced from them are not discouraging or humiliating. She is the daughter of a race of emigrants who have become a great people through work, energy, and determination. She has in this at her command a whole treasury of traditions from which she draws, not without pride. We might say, in listening to these stories, that we were hearing one of those *grandes dames* of the past century, emigrants and poor, telling with pride in their memoirs how, to supply their wants, they worked in London or in Germany, utilizing their accomplishments and their correct taste, and making trimmings and embroidering robes with their own aristocratic hands.

The American woman has no more false shame and silly conceit than they had. We can observe her at Paris, Nice, Pau, or in Switzerland, everywhere at ease, the first to laugh at her mistakes in language, or at her ignorance of continental usages. Wherever she may be she seems to be at home; and the country

that pleases her is, during the time she lives in it, her adopted country. The thought never occurs to her that she may be ridiculous or may appear so; or that a woman can be ridiculous or a man think it of her. Such is the confidence, justified by experience, which the privileges of her sex give her, that she has neither timorous reserve nor sickly timidity. Homage paid to her as a woman does not embarrass her, attention does not disconcert her. She is accustomed to them, and freely confesses the pleasure they cause her.

She is the resultant of a mode of education, of a kind of life that differs profoundly from ours. She has been taught to rely upon herself, to judge for herself. In her relations with men she has always been free but responsible, guardian of her own honor, and artisan of her future. She has seen and observed; she is not ignorant of the duties of life, or of the perils of independence. If the objection is made that this too premature knowledge is often liable to render her under a brilliant and sportive exterior coldly calculating and too early cautious, we may answer that she will sooner or later have to deduce her own conclusions from what surrounds her, of the world in which she lives, and that it may be better for her eyes to be opened to evidence and her judgment to be formed before making the decisive choice of her life.

It is hard in examining such a question to abstract one's self sufficiently from the usages and the ideas of the medium in which one lives—to be absolutely impartial. By instinct we are inclined toward accepted ideas, usual customs, and current axioms. Our own ideas are still too far away from those of the people across the sea for strong contradictions not to arise between them. In such a matter experience only is of value, and we can judge equitably only by results. Here experience is conclusive and the results are satisfactory.

If the American Union is to-day one of the first countries in the world, it owes the fact to a large extent to the American woman, who was and still is an important factor in its astonishing prosperity. The United States owes it to her that it has preserved the religious faith, the principle of vitality, imported by the Pilgrim fathers to the American shores. She has been the efficacious artisan of the work. She has maintained it, extended and enlarged it in the church and the school. In hours of difficulty, as during the war of independence and the war of secession, the patriotism of the woman sustained the courage of the man. Under all circumstances she was his companion and his equal. As such he respected her, and that respect which she inspired in him by her self-denial and her courage in the beginning, by her intelligence and good breeding afterward, by her charms and her confidence in his protection, has fashioned American manners, and has strongly

impregnated them with the idea that respect for his companion was for the man one of the prime conditions of moral life. This moral life is her own work. She created and she maintains it. In the cult of which she is the object, in the homage which man renders to her, there is more than the mysterious attraction which sex inspires: there is the instinctive recognition of a great and salutary influence nobly exercised.—*Selected and translated for The Popular Science Monthly from the author's article in the Revue des Deux Mondes.*

TEACHING PHYSICS.

By Prof. FREDERICK GUTHRIE, F.R.S.

THERE is no physical science without exactness, and there is no exactness without measurement. Far as we are still from understanding the mystery of life, it is not to be denied that the greatest advances in biology have been due to exactness in observation and quantitative comparison. This is more markedly the case with the sciences of geology and astronomy. Still more is this to be insisted on in the study of the forces of inanimate Nature. I have always, for instance, tried to persuade those of my friends who are engaged in teaching chemistry that they would do well to begin at once with quantitative methods and determinations in the laboratory, synthetic as well as analytic.

This quantitative element is still more essential in physics. There everything should be quantitative and exact. But there are different degrees of exactness. No one would expect from the average student of chemistry that all his analyses should be of the same degree of refinement as though he were determining the atomic weight of an element. Let his analyses be sufficiently exact to convince him of the faithfulness of Nature and the trustworthiness of the statements of the science.

Now, in bringing before you to-night a short account of the system of teaching practical or laboratory physics which has been adopted at the Government Science Schools with which I am connected, I must speak a few words as to the origin of that system.

The problem was briefly this. Given a class of students of various ages, from sixteen to sixty, and of various degrees of general knowledge and ability. Assume that they are all anxious to learn, and that none of them have worked systematically before in a physical laboratory, and let the instruction be limited to a few months—say four.

The problem is to give them a sound but necessarily elementary training in the science, so that all shall have an opportunity of acquiring such a knowledge of physics as no educated man should

be without, and no scientific man dare to be without, and to those who have the ability, the opportunity, and the desire, a trustworthy foundation on which to base their further studies.

The scheme almost necessarily formed itself into the following: The student attends a lecture every morning, except Saturday, at ten o'clock. These lectures, in the present case, are about seventy in number. At eleven o'clock he goes into the laboratory, provided with a few tools; there he finds the necessary material for making apparatus relating to the lecture. He has also printed instructions directing him how to make and how to use the apparatus when made. He finds also working models of such apparatus for his guidance. These instructions he carries out under the supervision and advice of a skilled assistant.

The instruments the student of average skill can and does make under proper instruction with these means are far more accurate than those he is at all likely to be able to buy. I do not say that his divided circles will be as accurate as those of Troughton and Sims, nor will his spectroscope compare with one of Hilger's, nor his resistance coils with those of Elliott, nor his barometer with the one at Kew; but I do say that his barometer is a far more exact instrument than one for which he would have to give several pounds; that his spectroscope will divide the sodium line; that his coils are true to the thousandth of their nominal value; that he can determine the wave-length of light to within $\frac{1}{1000}$ of the truth, the specific heat of a metal to $\frac{1}{100}$, and the length of a sound-wave to $\frac{1}{200}$ of the truth. The only bought instrument of precision which the student uses in the elementary course is the balance. He has generally, however, acquired some skill with this, and in the manipulation of glass, in the chemical laboratory.

Starting with a tuning fork which is given to him, and the monochord which he makes, the student is able to verify the intervals of the gamut as dependent on length of string. He then examines the effects of variation of diameter, of tension, and of weight of the string.

Tuning forks are, however, seldom exact. The actual pitch of the fork is found by the method of sinuosities. A smoked glass plate is dropped in front of a style on the fork, and so the fork writes its own number. Hence, by means of the length of the resonant cavity, the velocity of sound in air is obtained with some accuracy, and by the method of longitudinal vibrations the velocity in wood, glass, and brass, etc., follows. The rule of the transverse vibrations of rods is examined. The production of harmonics on strings, rods, and in tubes is shown, and a number of experiments follow concerning the velocity of sound in different gases as determined by dust figures.

Having made and graduated both a direct alcohol and a differential air thermometer, the absolute expansions of water and alcohol are determined. Very accurate results may easily be got as to the latent heats of water and steam. Then the student, having made his calorimeter, determines the specific heats of iron, copper, zinc, tin, and lead. The specific heats of a few liquids are determined either by direct comparison with water or indirectly with the metals.

In light, the chief work consists of the following: The making and use of the diaphanous and shadow photometers; the making of an instrument for examining the rules of reflection and refraction, and the verification of these rules; the determination of refractive indices of liquids and their dispersive powers; the images from curved mirrors, the measurement of focal lengths, and the curvative and refractive indices of lenses. A few experiments concerning plane polarized light are followed by the determination of the wave-length by a grating, and the construction and use of the spectroscope.

The principal pieces of apparatus constructed for work in electricity are: A gold leaf electroscope; a differential condenser; a sand-dropping accumulator; a Leyden jar; an electrophorus; a dry pile; a voltaic cell; a differential galvanometer; a resistance bridge; a set of resistance coils; a tangent galvanometer; a potentiometer; a thermo-element; a thermopile. And by these apparatus typical experiments and measurements, of which the following are a few, are made: The study of magnetic curves; the action of the current on the needle; the relation between length, weight, and resistance in wires; the effect of temperature on resistance; the law of divided circuits; specific resistance; electromotive force; internal resistance of cells, and so on.

Electricity, especially voltaic, lends itself perhaps more abundantly to exact measurements in the elementary laboratory than the other branches, and it is on this account, and because it is the last subject treated of, and so claims any spare time at the end of the term, that it occupies a rather prominent part. I do not hold that it has really any greater educational value than the other branches, and certainly in a general educational course it is not for me to give it prominence, because just now it has a considerable technical development. I trust the time may never come when any branch of physics will be considered as of comparatively little importance in general education.

To-day I have particularized the method of teaching one branch of science. I have had to use strong language, for I feel strongly, and I have been addressing strong people. Of this, at least, you and all men may be well assured, that I will not cease to proclaim, as long as strength is given to me, that the hope of

science is the hope of the world; that while I yield to none in my love of imagination, of literature, and of all the fine arts, they are as the gracious flowers of the mind-plant whose leaves and roots are the truths of science. True that the living plant is most beautiful when it is in blossom. He who plucks off the flower, while marring the beauty of the plant, destroys the fruit forever. —*Abridged from the Journal of the Society of Arts.*

RECENT SCIENCE.

By PRINCE KROPOTKIN.

I.

DURING the last thirty years the data of meteorology have been accumulated with a very great rapidity, and the chief desideratum of the moment is, to construct with these data such a general theory of the circulation of the atmosphere as would embody the distribution of heat, pressure, moisture, and winds over the surface of the earth, and represent them as consequences of well-established mechanical laws. The old provisory hypothesis of atmospheric circulation, advocated by Hadley in 1735, and further elaborated by Dove in our century, can be held no more, and a new theory has become of absolute necessity.

We all have learned Dove's theory at school, even though we often found it difficult to understand. The air, greatly heated on or near the equator, rises in the same way as it rises in the summer over a sunburned plain. On reaching the higher strata of the atmosphere it flows toward the poles, but, owing to the speed of rotation which it has acquired in the lower latitudes, it is deflected—to consider the northern hemisphere only—to the right, and blows in the upper strata as a current from the southwest. To compensate this flow, air rushes on the earth's surface toward the equator, and as it also is deflected from its course by the same inertia of rotation, it appears in the tropics as a trade wind blowing from the northeast. However, the upper warm current does not flow all the way to the pole in the upper regions; it is gradually cooled down, and in about the thirtieth degree of latitude it begins to descend to the earth's surface, where it meets with the cold polar current. A struggle between the two winds ensues, and it lasts until they make a temporary peace by blowing side by side, or one above the other, the struggle giving origin to storms and to changes of wind which are fully analyzed in Dove's theory. A rope without end rolling over two pulleys, one of which lies horizontally near the equator, and the other stands upright in

higher latitudes—such was the simplest expression of Dove's theory given in text-books.*

Under this provisory hypothesis meteorology made an immense progress, and some five-and-thirty years ago, Leverrier in France, and Fitzroy in England, ventured for the first time to foretell weather twenty-four hours in advance, or at least to send out warnings as to the coming storms. This bold step brought meteorologists face to face with a quite new problem. From the air pressure, the temperature, the moisture, and the winds observed at a certain hour of the day at various spots and telegraphed to a central station, they had to infer the next probable state of weather. So, leaving aside the great problems of atmospheric circulation, they directed their attention to the changes of weather rather than to the causes of the changes.† For this purpose purely empirical laws were of great value. When the meteorologist saw on a weather chart a region of low atmospheric pressure, with winds blowing in spirals round and toward its center, he named it, by analogy with real cyclones, a "cyclonic disturbance" or a "cyclone," giving the name of "anticyclone" to the region of high atmospheric pressure—and he studied the tracks of both disturbances in their advance across the oceans and the continents. He did not inquire for the moment into the causes of the disturbances; he took them as facts, and, following Buys Ballot's law, he said that the wind will blow as a rule from the region of high barometic pressure (the anticyclone) to the region of low pressure (the cyclone), with a certain deflection to the right or to the left. Immense researches were made to study the routes followed by the centers of barometrical minima, and we now have splendid atlases showing the normal tracks of cyclones across the Atlantic Ocean, over Europe and the States, in Japan, in the Indian Ocean, and so on, at various seasons of the year.‡ With these empirical data meteorologists attained such a perfection in their weather forecasts that in five cases out of six their previsions are now correct, while the coming gales are even foretold with a still greater accuracy.

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* E. E. Schmid, Lehrbuch der Meteorologie, Leipsic, 1860, p. 568.

† See W. Bezold's short sketch of meteorological progress in Sitzungsberichte der Berliner Akademie der Wissenschaften, 1890, ii, 1295, *sq.*

‡ Besides the earlier works of Ley (Laws of the Winds prevailing in Western Europe, Part I, 1872) and Köppen (Wissenschaftliche Ergebnisse aus der monatlichen Uebersichten des Wetters, 1873–'78), we have now the splendid work of W. J. Van Bebber, which embodies the tracks of all cyclones in Europe for the last fifteen years (Die Zugstrassen der barometrischen Minima, für 1875–'90), the researches of Blanford, S. E. Hill, and Elliot in the Indian Meteorological Memoirs and Cyclone Memoirs, Part IV (published by the Meteorological Department of India), the work of E. Knipping for Japan, in Annual Meteorological Report for 1890, Part II, Appendix, and several excellent works for Russia.

However, the very progress achieved demonstrated the necessity of a more thorough knowledge of the too much neglected upper currents of the atmosphere. In Dove's scheme, the upper equatorial current, after part of it had been sent back to the equator, was entirely abandoned to itself, to make its way as best it could against the opposed polar winds; but the existence of a strong, nearly permanent, and relatively warm upper wind blowing toward the east in our latitudes—which was only probable thirty years ago*—became more and more evident, especially since the movements of clouds began to be systematically studied and observatories were erected on high mountains; and this wind remained unexplained in Dove's theory, while in Maury's scheme of atmospheric circulation, which is still in great vogue in our schools, there was even substituted for it a current in an opposite direction, which does not exist, and which Maury himself could not account for.† An entire revision of the subject was thus necessary, and this revision has been done by the American meteorologist Ferrel, in a series of elaborate works which are only now beginning to receive from meteorologists the attention they fully deserve.

Ferrel's theory is based upon considerations as to the laws of motion of liquids and gases of different densities. If the whole atmosphere were equally heated in all its parts, and at full rest, the air would be disposed in horizontal layers, of greater density at the bottom, and of decreasing density toward the top. Considering some part only of the atmosphere, from pole to equator, and neglecting the curved surface of the earth, we should thus have something analogous to a trough filled with layers of different liquids. If one end of the trough were now warmed, and the other end were cooled, the layers would be horizontal no more.

* Observations in Siberia—namely, at the graphite works on Mount Alibert, at a height of eight thousand feet (52° north latitude)—were especially conclusive. Alibert's observations, buried in the Russian *Trudy* of the Siberian expedition, proved the existence of a nearly permanent west and west-northwest wind on the top of the peak, and they showed at the same time that the average yearly temperature on the top of the peak was by some fourteen to eighteen Fahrenheit degrees higher than it otherwise ought to be. When I visited the then abandoned mine in 1864, and saw the peak dominating all surrounding mountains, and could judge of the force of the west wind from the immense works accomplished to protect the road which was traced on the western side of the peak, I could not refrain from explaining the extraordinary great height of the snow-line in east Siberia by the existence of a relatively warm equatorial current blowing with a great force at a height of from eight to ten thousand feet in the latitude of 52° north. Later on the observations which I brought from the Voznesensk mine (60° north, altitude twenty-six hundred and twenty feet) induced my friend Ferd. Müller, who calculated those observations, to conclude that in higher latitudes the same current descends still lower to the earth's surface, and still maintains some of its initial warmth.

† See James Thomson's paper On the Grand Currents of the Atmosphere, in Philosophical Transactions, A. 1892, p. 671.

They would be inclined, but in two different ways: the lower ones would be inclined toward the warm part, while in the upper layers the inclination would be the reverse. A full circuit of the lighter liquids flowing one way on the surface, and of heavier liquids flowing the other way on the bottom, would thus be established. The same would happen in our atmosphere with the lighter warm currents and the heavier cold currents if the earth had no rotation on its axis. But it rotates—the solid globe as well as its gaseous envelope—and this modifies the whole circulation. The air which flows from the equator to the poles maintains, not its velocity of rotation, as has been hitherto taught, but its energy of rotation, which means that it obeys the law of preservation of areas; therefore, when it is transported from the equator to a higher latitude it is endowed (in the northern hemisphere) with a much greater easterly velocity than if it simply maintained its speed of rotation. On the other side, the air which is flowing from the higher latitudes toward the equator also obeys the same law and acquires a westward velocity, but much smaller than the eastward velocity of the former; this is why the west winds have such a preponderance in our latitudes.* Moreover, in virtue of the centrifugal force, all masses of air moving in *any* direction—not only north or south, but also due west or east—are also deflected to the right in the northern hemisphere, and to the left in the southern hemisphere.† Consequently the air flows in great spirals toward the poles, both in the upper strata of the atmosphere and on the earth's surface beyond the thirtieth degree of latitude; while the return current blows at nearly right angles to the above spirals, in the middle strata as also on the earth's surface, in a zone comprised between the parallels 30° north and 30° south.‡

Such are, very briefly stated, the leading features of the theory which Ferrel laboriously worked out during the last thirty years, submitting all its parts to the test of both observation and mathematical analysis. By the end of his life (he died in 1891) he embodied his theory in a well-written and suggestive popular work,

* Full tables giving the eastward (or westward) velocities for each latitude, under the two different hypotheses, have been calculated for the Meteorologische Zeitung, 1890, pp. 399 and 420.

† Ferrel seems not to have been aware that the same had been demonstrated by R. Lenz for rivers (about the year 1870), in a discussion of Baer's law, applied to the Amu River, in the Mémoires of the St. Petersburg Academy.

‡ William Ferrel, A Popular Treatise on Winds, comprising the General Motion of the Atmosphere, Monsoons, Cyclones, Tornadoes, Waterspouts, Hailstorms, etc. New York: Wiley, 1889. See also analysis of it by W. M. Davis (in Science, xv, p. 142; translated in Meteorologische Zeitung, 1890; Literaturbericht, p. 41), who gave the best diagram of circulation according to Ferrel's theory, and by H. F. Blanford in Nature, xli, 124. A full bibliography of Ferrel's works was given after his death in the American Meteorological Journal, October, 1891.

which fully deserves being widely known. All taken, his views so well agree with the facts relative to the movements of the atmosphere, and they give such a sound method for further investigation, that they are sure to become for some years to come the leading theory of meteorology. They already have given a strong impulse to theoretical research, and have created a whole literature in Austria and Germany.*

Another theory of the general circulation of the atmosphere which is also awakening a good deal of interest among physical geographers was propounded in 1886 by Werner Siemens, and further developed by him in 1890.† Siemens did not consider that air might flow down the density surfaces, as supposed by Ferrel and Helmholtz, and admitted by many meteorologists, and he maintained that the source of the energy required for all disturbances of equilibrium in the atmosphere must be looked for in the unequal heating of its different strata by the sun, and in the unequal loss of heat through radiation in space. From these considerations he inferred the existence of an ascending current in the equatorial belt, an upper warm current, and a cold polar current. As to the eastward and westward directions of these currents, he made the very just remark that the energy of rotation of the whole atmosphere must remain constant and unchanged, even though masses of air move from one latitude to

* Roth has already abandoned the mathematical objections he had raised against Ferrel's theory in the Wochenschrift für Astronomie, 1888. The objections raised by Teisserenc du Bort and Supan against the "density surfaces" have been answered by Prof. Davis in Science, and are not shared by the most prominent meteorologists. And the mathematical analysis of Prof. Waldo, Sprung (the author of the well-known Treatise of Meteorology), M. Möller, and Pernter has further confirmed the accuracy of the theory. So also Hildebrandsson's observations of upper clouds (Annuaire de la Société météorologique de France, xxxix, 338), Teisserenc du Bort's high-level isobars, and Guaran de Trommelin's researches relative to coast winds. The transport of the Krakatoa dust and Abercromby's observations of clouds having rendered the existence of an upper east current very probable on the equator, Pernter has mathematically deduced from Ferrel's theory the existence of such a current in a belt 4° 45′ wide on both sides of the equator, and he therefore has withdrawn the restrictions he had previously made in a lecture (published in Nature, 1892, xlv, 593) in favor of Siemens's views. It must be added that the idea of three superposed currents blowing in spirals may have been suggested to Ferrel by a communication of James Thomson to the British Association in 1857. Such was, at least, the claim raised and developed at some length by the Glasgow professor before the Royal Society in a Bakerian lecture, now published in the Transactions (A. 1892, pp. 653–685). Though Thomson's paper was never published, and only given in a very short abstract without a diagram (the diagram in the Transactions is now published for the first time), the few lines in which his theory was stated (British Association Reports, Dublin, 1857, pp. 38, 39) contained the idea clearly expressed. It is certainly a matter of great regret that James Thomson has not returned to this subject.

† Ueber die Erhaltung der Kraft im Luftmeere, in Sitzungsberichte der Berliner Akademie der Wissenschaften, March, 1886, p. 261; Ueber das allgemeine Windsystem der Erde, in same publication, 1890, ii, p. 629.

another. The velocity of rotation of the atmosphere in tropical latitudes must therefore lag behind the rotation of the earth, and it must outstrip it in higher latitudes, mathematical calculation proving that the thirty-fifth parallel is, in both hemispheres, the line of division between the two. The general system of air circulation deduced from these principles is very similar in its results to the system of Ferrel; but the interest and importance of Siemens's views lie elsewhere. His memoirs were an appeal and an attempt to apply the principles of thermodynamics to the aërial currents, and they have opened the way for a series of important researches, which, however, are not yet sufficiently advanced to be discussed in these pages.

And, finally, a third new point of view has been introduced into the same discussions by Helmholtz. Sitting one day by the seaside, and observing how wind blows on the surface of the sea by sudden gushes, how it originates waves, and how they grow when wind blows with an increasing force, Helmholtz came to consider what would happen with two air currents blowing one above the other in different directions. A system of air waves, he concluded, must arise in this case, in the same way as they are formed on the sea. The upper current, if it is inclined toward the earth's surface (as is often the case), must originate in the lower current immense aërial waves rolling at a great speed. We do not generally see them, but when the lower current is so much saturated with moisture that clouds are formed in it, we do see a system of wavelike parallel clouds, which often extend over wide parts of the sky. To calculate the sizes of the waves in different cases is extremely difficult, if not impossible; but by taking some simpler cases Helmholtz and Oberbeck showed that when the waves on the sea attain lengths of from sixteen to thirty-three feet, the air waves must attain lengths of from ten to twenty miles, and a proportional depth. Such waves would make the wind blow on the earth's surface in rhythmical gushes, which we all know, and they also would more thoroughly mix together the superposed strata, dissipating the energy stored in strong currents. These views are so correct that they undoubtedly will throw some new light, as they already begin to do, upon the theory of cyclones.*

At the same time, Bezold is now endeavoring to reconstruct meteorology from the point of view of thermodynamics;† and the well-known Austrian meteorologist, J. Hann, whose work is

* H. Helmholtz, Zur Theorie von Wind und Wetter, and Die Energie der Wogen und des Windes, in the Sitzungsberichte of the Berlin Academy, 1889, ii, and 1890, ii. Oberbeck's calculations of the waves are given in the Meteorologische Zeitung, 1890, p. 81.

† Zur Thermodynamik der Atmosphäre, in Sitzungsberichte of the Berlin Academy of Sciences, 1888, p. 485; same year, p. 1189; 1890, p. 355; and 1892, p. 279.

exciting just now a great deal of interest, has openly broken with the old theory as regards the origin of cyclones and anticyclones.* From observations made for several years in succession on the top of the Sonnblick—a peak twelve thousand feet high, of the Tyrolese Alps—as well as from observations made on several high-level stations, he has concluded that a cyclone can *not* be due to a local heating of the earth's surface and to an ascending current of warm air provoked by this cause, just as an anticyclone can not be due to a local cooling of the earth's surface, and to a consequent condensation of the air. Contrary to the previsions of the meteorologists, the ascending column of air within a cyclone, up to a height of some ten thousand feet, is not warmer than the surrounding air; it is *cooler* within the cyclone, and its upward motion thus can not be due to its temperature. So also in an anticyclone the descending current of air is *warmer* than it is under normal conditions, and its downward motion must be due to some other cause than an increase of density resulting from a lowering of its temperature. The decrease of pressure in the one case, and its increase in the other, thus can not be caused by differences of heating or cooling of the lower strata; and both cyclones and anticyclones must be considered as parts of the general circulation of the atmosphere, such as it was conceived by Ferrel.†

Such a deep modification of the current views, though supported to a great extent by weighty evidence, will obviously not be accepted without opposition; but it is already making its way, and certainly will exercise a deep influence on the further development of meteorology.

Abandoning now the domain of theoretical investigation, I must mention a work—also a life's work—which may safely be placed side by side with the best achievements in theory. I mean the beautiful charts of Mr. Buchan, representing the distribution of pressure, temperature, and winds over the surface of the globe, embodied in the last volume of the Challenger Expedition Reports. When Mr. Buchan published twenty-three years ago his first maps of monthly isobars and prevailing winds, they were quite a revelation, even though the data upon which they were based were very incomplete at that time.‡ But better data have

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* Das Luftdruckmaximum vom November 1889, in Denkschrift der Wiener Akademie der Wissenschaften, 1890, Bd. lvii, p. 401. Bemerkungen über die Temperatur der Cyclonen und Anticyclonen, in Meteorologische Zeitschrift, 1890, p. 328.

† See the discussion of this subject between Hazen and J. Hann in Science, 1890, xv, 382–384, and Meteorologische Zeitschrift, 1890, p. 328.

‡ To trace the isobars, or lines of equal atmospheric pressure, reduced to the sea-level, the real altitude of each meteorological observatory must be known from direct geometrical levelings; but in 1869 the altitude of not one single station in Siberia, central Asia, or even the Urals was known. A leveling across Siberia, as far as Lake Baikal, has been

been collected since, and in the hands of Mr. Buchan they have undergone such a careful and able analysis that the Challenger Reports charts may be taken as the best reliable representation of the winds, the temperatures, and the pressure in the lowest strata of the atmosphere, as well as the surest basis for further generalizations.* The theories which have been mentioned in the preceding pages give the grand lines of atmospheric circulation; on Buchan's maps we see how the grand lines are modified in the lowest strata by the distribution of land and sea, and the unequal heating or cooling of continents and oceans. The leading features indicated by theory are still maintained, and they become even still more apparent if we consult isobars traced for a certain height, like those of Teisserenc de Bort; but the immense plateaus of East Asia and North America act in winter as colossal refrigerators, where cold and heavy air accumulates, to flow down in all directions toward the lowlands. We see also how in July the air is heated in the lower lands of northwest India, in the corner between the Afghanistan and the Thibet plateau, how pressure is lowered there by the ascending current, and how winds blow toward this region of lowered pressure. We see more than that: on looking on the maps it strikes the eye how the moisture or the dryness of the climate is dependent upon the distribution of pressure, and how the dry anticyclonic winds make barren deserts of parts of North and South America, of Africa, and central Asia, and how they will continue to dry the lakes and the rivers of these regions and occasion total failures of crops so long as that distribution of pressure lasts on the globe, and man has not yet learned to eschew its effects by getting water from the depths of the earth. The life of the globe during the present period is written on these splendid charts.—*Nineteenth Century.*

M. THORADDSEN, in the narrative of his travels in Iceland, observes a peculiar feature of the oases at the foot of Mount Hecla. These oases are subject to constant displacement by the violent sandstorms which are common. On the windward side all vegetation is gradually destroyed, while on the other side grass takes root, and in a wonderfully short time the level and sterile surfaces are converted into good pasture lands.

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made since, Mr. Buchan's isobars having been one of our best arguments to press the necessity of the leveling. But Mr. Buchan may not be aware that the leveling beyond the ninetieth degree of longitude is now considered by Russian geodesists as utterly unreliable; it is supposed to contain some substantial error, so that a new leveling between Krasnoyarsk and Lake Baikal is insisted upon. The incertitude in the isobars on an immense space in northeast Asia resulting from this cause may attain as much as one or, perhaps, even three tenths of an inch.

* An excellent *résumé* of the whole work and its results in a popular form has been published by Buchan himself in the Proceedings of the Geographical Society, March, 1891.

IS CRIME INCREASING?

THE question whether crime is increasing or decreasing in England and Wales has been the subject of an interesting discussion in The Nineteenth Century between the Rev. William Douglas Morrison, chaplain to the prison at Wandsworth, and Sir Edmund F. Du Cane. Mr. Morrison remarks upon the incertitude and diversity of opinion prevailing on the subject as something which it is desirable to clear away, and attributes the perplexity of the public mind in the matter, in the main, to the erratic and haphazard manner in which criminal statistics are frequently handled. One of the most obvious mistakes, and yet one which is frequently committed in dealing with questions of crime, is to draw sweeping inferences from the criminal statistics of a single year, or even of a short series of years. "It has to be remembered that criminal returns are largely affected by the fluctuating conditions of social existence, some of the more important of these being the rise or decay of political or industrial agitation, the ebb and flow of commercial prosperity, and, more rarely, the emotions aroused among the population by a state of war. In order as much as possible to neutralize the disturbing effect of these inconstant social factors, it is essential that all statistics relating to crime on which it is proposed to build any general conclusions should cover a decade at the least, and unless this principle is adhered to misleading ideas are almost certain to arise." Sir Edmund Du Cane thinks that even ten years are hardly a long enough period on which to base correct conclusions.

In Mr. Morrison's investigation of the subject three methods of treatment present themselves for consideration. The total number of offenses as reported to the police may be taken as a criterion; or the number of cases tried, both summarily and by indictment; or the total number of convictions. In order to appreciate the movement of crime in all its various aspects, each of these three methods is more or less necessary.

The returns of the yearly average of trials in the three decades 1868 to 1889 reveal an increase from 466,087 in the first decade to 701,060 in the third, satisfying Mr. Morrison that the total volume of crime has increased very materially within the period. Among the causes which have fostered this growth, he assigns an important place to the development of social legislation. Offenses against the Elementary Education Acts alone, he says, "have furnished considerably more than half a million cases, and other acts of a like character have produced similar results. But the growth of offenses arising from a continuous widening of the sphere of legislative effort is to some extent counterbalanced by

the abolition in recent years of several old penal laws, as well as by the greater reluctance of the police to set the law in motion against trivial offenders. . . . Offenses may be growing, but the population may be increasing still faster; the question, therefore, requires to be considered, to what extent the total number of cases tried is keeping pace with the general growth of the community. Basing our calculations upon the estimated population at each decade, it comes out that in 1860–'69 one case was tried annually for every forty-four of the inhabitants of England and Wales; in 1870–'79, one for every thirty-seven inhabitants; and in 1880–'89, one for every thirty-eight. According to these statistics, the proportion of crime to the population has remained almost the same for the last two decades; but, if the last two decades are compared with the first, the growth of crime has outstripped the growth of population."

The question whether crime is increasing in seriousness along with its expansion in volume may be answered best by an analysis of the number and nature of the indictable offenses brought up for trial during the three decades. The figures disclose a continuous decrease; but opposed to this is the fact that the cases of offenses against property without violence, constituting two thirds of the whole number tried in the first decade, were more usually dealt with summarily during the two subsequent decades. For arriving at a more accurate estimate of the serious crimes committed in the first decade, Mr. Morrison selects as a type murder, concerning which no material change in public feeling or judicial procedure has taken place within the last thirty years. The figures—126 in the first decade to 153 in the third—show that this, the most serious of all crimes, has steadily increased within the last three decades, and that in proportion to the growth of population it was nearly as common in the last decade as in the first. The author believes, therefore, that the apparent decrease in indictable offenses is attributable to a change of criminal procedure rather than to an actual decrease of serious crime. Even after the Summary Jurisdiction Act was passed, by which a large number of cases were taken out of the indictable list, every form of serious crime appears to have relatively increased. Large increases in the average of commitments to prison, the extension of juvenile and reformatory schools, and the rapid and uninterrupted augmentation of the police force, are further adduced as pointing to the conclusion that "crime during the last thirty years, for which we possess official returns, has not decreased in gravity, and has been steadily developing in magnitude."

The explanation of this supposed increase is sought in the concentration of men in large cities and industrial centers.

Sir Edmund Du Cane criticises Mr. Morrison's methods, fig-

ures, and conclusions unsparingly, and declares as the best opinion he has been able to form on a review of all the facts, and from the expressions of persons whose practical connection with the subject gives weight to their views, that crime is decreasing. He cites the returns of the prison population since 1877 as showing a continuous annual decrease, which none of the explanations offered adequately account for except those which ascribe it to the depression of trade cutting off the supply of money for drinking with, or to the growing dislike of a certain class of criminals for life in prison—both of which imply a decrease of crime. He ascribes the decrease to Christian philanthropy, which he says has never attained a higher development than now, when it is perhaps one of the principal features of the present stage of civilization. It "has led to an entirely new way of dealing with crime—namely, by prevention instead of by punishment; and one of the principal results of this philanthropic idea is the establishment of industrial schools, in which young persons who seem likely to fall into crime and to develop into adult criminals may be trained into a better way and made into useful members of society.

"It has led to those movements for providing better dwellings, and otherwise raising the condition of those who are sometimes called 'the disinherited,' sometimes 'the submerged,' which help to remove temptations to crime, and purify the atmosphere in which those who may develop into criminals have been compelled to live.

"It is perhaps one of the most curious features in the proof offered of the increase of crime that the adoption and development of the very means by which it is diminished are cited as corroborations of the doctrine that it has increased—among them being the increase in the number of juveniles committed to industrial schools. To show this we are given the number of those committed to 'reformatories and industrial schools' added together. The reformatories are penal and reformatory institutions for young persons convicted of crime, and correspond, therefore, to prisons. The industrial schools, on the other hand, are preventive institutions for children who have not been convicted, but might fall into crime for want of proper care and training. To mix the two together obviously obscures the facts, and the more thoroughly because the committals to reformatories have decreased during the last ten years, so that the increase in the united numbers is solely due to the development of the distinctly preventive institutions, to which there is little doubt the decrease in crime and criminals is largely due, and which are the product of the Christian civilization of which Rousseau thought so little. In fact, mixing the two together is as if an increased prevalence of small-pox was proved by adding together the num-

ber of people who developed the disease and the number who were vaccinated to guard against it. Further than this, the figures given in the article [Mr. Morrison's] compare the three decades beginning in 1860, 1870, and 1880, and show, what is true enough, that the number of inmates of these two classes of institutions has increased in each ten years; but this does not show an increase of convicted or even of potential criminals, but only reminds us that there were comparatively few such schools until the great development of these institutions took place after the Reformatory and Industrial Schools Acts were passed, in 1866, for the purpose of encouraging them, and that advantage has been taken of them with still greater vigor in connection with the Education Acts passed in and since 1870.

"In a similar way the increase in the police force is cited as a proof of the increase of crime. If this view were sound, we should expect to find that when there was no police force at all it was because there was no crime—a paradox which, perhaps, it is not necessary to spend time in refuting. Many years ago no traveler could cross Hounslow Heath, Wimbledon Common, or similar desolate approaches to the metropolis, without a good chance of being robbed. Hanging those who were caught did not check this inconvenience; but at last Sir John Fielding hit upon the idea that it might be prevented, and established the armed horse patrol, which soon put a check on the highwaymen. Their appointment was no sign that highway robbing had increased; it was only a better mode of preventing it. Another most potent mode of preventing crime is by making detection more certain. . . . An increase in the police force, with a view to their greater preventive efficiency, is no more a sign that crime has increased than an increase in the amount spent in drainage and water supply, when towns and localities become alive to their advantage, is a proof of increased unhealthiness in places which have adopted such preventive precautions. If an inquiry into the health of a town was to assume that the increased activity of drainage was a sign of increasing bad health, and was altogether to ignore and pass over the evidence afforded by the improved death-rate and the opinion of the medical men of the town, it would be precisely similar to taking the increased activity in progressive development of these preventive institutions as a sign of increase of crime, omitting altogether any investigation into their effect on the number of the criminal classes or disorderly houses, and ignoring the direct testimony of the police, who must know how these matters stand."

A large proportion of the duties of the police, moreover, have nothing to do with crime. The mere collection of large numbers of people together makes a police necessary without any reference to the crime they actually commit.

The police every year furnish a return of the number of the criminal classes. A comparison of the numbers given in these returns affords what seems to be irresistible testimony of an immense improvement. Since the year 1867–'68 the decrease in their number has been practically continuous. Is it conceivable that, while the criminal classes have diminished in this manner, crime has increased?

The direct testimony of the police themselves may be cited. The commissioner of police of the metropolis adduces facts and figures from which it "appears that there was greater security for person and property in the metropolis during 1890 than in any previous year included in the statistical returns"; and this, notwithstanding the increasing growth of the city at the rate of a million a decade, makes it continually more difficult for the police to deal with crime. The chief constable of Liverpool says that "never since the first publication of returns of crime in Liverpool (i. e., since 1857) have the statistics disclosed so small an amount of crime or so large a success in making criminals amenable to justice as those for the year ended the 29th of September, 1891." The report for 1892 is to the same effect, except that crimes of violence had slightly increased.

Mr. Grosvenor, of the Home Office, in a paper on The Abatement of Crime, read to the Statistical Society in 1890, spoke of the abatement having taken place in nearly all classes of crime during the last twenty years; of the "reduction in the number of known thieves and other suspected persons at large, as well as of houses of bad character which they frequent," and of the extraordinary diminution in the number of receivers of stolen goods. Adding to this the fact of the great increase in the population of the country, "we must admit," he says, "that the many agencies enlisted for the purpose of diminishing the number of criminals have been most successfully applied, and the result can not fail to afford the utmost satisfaction and encouragement to all who are anxious for the improved moral and physical advancement of our nation."

Before considering the figures that measure the fluctuation in the actual crimes, Sir Edmund Du Cane tries to define what is meant by the word crime as used in the discussion. One studying the tables with a view to ascertaining the fluctuations in crime, looking merely at the total number at the foot of them, would probably conclude that the total volume of crime has increased very materially, for the tables show apparently a very considerable increase; "but if we look a little more closely at these totals of which the figures are made up, we see that a very large proportion of these offenses are not 'crimes' at all, as the word is ordinarily understood. For instance, offenses against the Education

Acts could not be committed before 1870, but they count for 96,601 in the latter year. Few people, however, would say that 'crime' was increasing and civilization demoralizing us because we now compel parents to send their children to school, and hale before the magistrates those who fail to do so, not having yet been accustomed to accept the new law. Offenses against local acts and borough by-laws, which are not 'crimes,' have in the same time increased from 35,681 to 59,108; begging and other offenses against the vagrant acts, from 41,780 to 46,019; offenses against the highway and similar acts, from 29,837 to 32,889. If the efforts that are being made to make it a penal offense to work more than eight hours a day are successful, we might expect to find several hundred thousand added to the number of offenses brought before the magistrates, but nobody would consider this a proof of increase of 'crime.' To find out, therefore, whether crime has increased or decreased, it is necessary to extract from the mass of figures those which really illustrate this point. The judicial statistics have provided an excellent classified analysis of the offenses in which those that consist of breaches of the laws for the protection of the person or property are set forth in five classes, which constitute substantially what people have in their minds when they speak of an increase or decrease of crime. The tables distinguish between offenses summarily dealt with and those not so treated as indictable offenses. Offenses of the latter class only are included in the classification. These consist of offenses against the person, including assaults; offenses against property, with violence; offenses against property, without violence; malicious offenses against property; and forgery and offenses against the currency." The tables, as summarized by the author, afford clear evidence of a continuous decrease in the number of crimes committed both indictable and summary, which is fatal to the theory of an inevitable increase.

Such results, Sir Edmund Du Cane observes, should be no matter of surprise, as they have, to all appearances, followed the preventive measures taken in order to effect them, among which are particularly specified the establishment of institutions to guard young people from falling into crime. This is further corroborated by the decrease in the number of first convictions, and the diminution in the number of young persons (under sixteen years of age) committed to prison (which includes all those sent to reformatories).

The author makes no reference in his review to punishment as in any degree the cause of the decrease in crime which he sets forth, "though," he says in his concluding paragraph, "I well remember that, when crime was increasing, it was at once set down to the prison system. I will not endeavor to appraise the

share which punishment has in the decrease of crime, but will repeat that in my opinion prevention is far and away better than any possible cure, and that next to prevention stands certainty of detection and of bringing to justice. Punishment, then, naturally comes into operation to serve as a warning and a deterrent to the wavering, and to the detected culprit a chastening experience, that should always be accompanied by influences calculated to reform."

SKETCH OF CHARLES A. JOY.

By MARCUS BENJAMIN, Ph. D.

IN tracing the growth of science in this country it is interesting to observe how its development may be followed in the biographies of its leaders; thus, many of our scientists received their first inspiration from the elder Silliman, while those of a later date acquired their great fondness for the life-work to which they devoted themselves from Louis Agassiz. From the leaders the growth of science passed to the institutions with which originally they were connected; then broadening, it located itself permanently with those having the best instruction. In a less degree, but equally true, is such the case in our cities. The story of the development of science in New York city can be acquired almost entirely by reading the lives of such men as Samuel Latham Mitchell, James Renwick, John Torrey, John William Draper, and John Strong Newberry. From these men its growth passed in time to such institutions as Columbia College, the New York Academy of Science, the University of the City of New York, and the Columbia College School of Mines.

In the development of chemistry in this city CHARLES ARAD JOY took a prominent part; and if, perhaps, his name is not as well known as some others, it must be attributed to the long years of retirement—many of which were years of suffering—that he passed in Europe and in his country home prior to his recent death.

Prof. Joy was born in Ludlowville, Tompkins County, New York, on October 8, 1823. His father was a well-known merchant, but a fondness for literary pursuits seems to have been the habit of the family. An elder brother became distinguished as an able physician, and a sister married an eminent clergyman. With his brother he studied at excellent preparatory schools in Ovid, N. Y., and in Lenox, Mass., and then was sent to Union College, where he was graduated in 1844. Choosing law as his profession, he entered Harvard, where he graduated in course at its law department in 1847, receiving the degree of LL. B. Meanwhile he had

acquired a fondness for science. The beginnings of the application of electricity to every-day life were manifesting themselves in the development of telegraphy under the direction of Samuel Finley Breese Morse. The wonderful richness of the Lake Superior region in mineral wealth had just been made known and the first copper mines opened, revealing almost pure metallic copper to the astounded world. It was also while Joy was a student at Harvard that Louis Agassiz gave his first course of lectures before the Lowell Institute in Boston, and it may have been, indeed perhaps was, these lectures that led him to abandon the following of a legal career in order to become a scientist. Moreover, he was happy at this time in meeting Charles T. Jackson, one of the most interesting characters in the history of American chemistry, in whose laboratory, which was early opened to private students, the original researches on the anæsthetic properties of ether are said to have been made.

In 1847 Dr. Jackson was commissioned by Congress to survey the mineral lands of Michigan, and promptly on finishing his course at the law school Joy was invited to become a member of the party, and continued with this expedition until the completion of its work. He then studied for a time in Dr. Jackson's laboratory; but realizing the impossibility of acquiring a thorough training in chemistry in this country, he turned his steps toward the Mecca of that science, and for two years studied in Germany, first under Heinrich Rose in Berlin and then under Friedrich Wöhler in Göttingen, where in 1852 he took the degree of Doctor of Philosophy. For an inaugural thesis the difficult subject of the combination of alcohol radicals with selenium was assigned to him, while at an adjoining desk a similar research pertaining to the tellurium compounds was being carried on by Prof. John W. Mallett, now of the University of Virginia. In after years Prof. Joy frequently related to his classes how that, owing to the offensive odors generated in the preparation of the selenium and tellurium compounds, he and his fellow-student, Mallett, were often the only two who remained at work. These researches were among the earliest contributions to a class of alcohol radicals combined with a metallic base that appeared in chemical literature. After receiving his degree at Göttingen he spent some time at the Sorbonne in Paris, where the brilliant Dumas, then in his prime, lectured on chemistry.

With a scientific training seldom equaled by any young man he returned to America, and was promptly called to the chair of Chemistry in Union College. This place he then held for four years, during part of which time he was assisted by Charles F. Chandler, who later became Professor of Analytical and Applied Chemistry in the School of Mines of Columbia College, and, sub-

sequent to the resignation of Prof. Joy, his successor in the chair of Chemistry in Union.

In 1857 Columbia College moved to its present site in Madison Avenue, between Forty-ninth and Fiftieth Streets, and the chair of Natural and Experimental Philosophy and Chemistry, then held by Prof. Richard McCulloh, was divided so as to form the chair of Mechanics and Physics, which was retained by Prof. McCulloh, while a call to that of Chemistry was given to Prof. Joy. It is perhaps worth recording that the only other candidate suggested for the new chair was Dr. Wolcott Gibbs, an alumnus of Columbia, in the class of 1841, then Professor of Physics and Chemistry at the College of the City of New York, whence, in 1863, he was called to the Rumford chair in the Lawrence Scientific School of Harvard.

With the prestige of a splendid education, a successful career at Union, and with fine social qualities, Prof. Joy was indeed well fitted to advance the course of chemistry in Columbia. Almost at once he founded in connection with his department a School of Chemistry, designed to give a complete professional education in chemistry to such as desired it. In the prospectus he wrote, "The laboratory is furnished with the best modern appliances for acquiring a thorough knowledge of chemistry and the applications of the science to agriculture and the arts." Among those who availed themselves of this instruction were Major Clarence S. Brown, Captain William Jay, and other officers of the United States army; also such mining engineers as George William Maynard, Edward M. Pell, and others; while classed as chemists were Julius H. Tieman, Peter C. Tieman, and William J. Youmans. The success of this experiment made it easily possible, in 1863, to interest the trustees of Columbia College in accepting the plan proposed by Thomas Egleston, Jr., for the establishment of a School of Mines. Prof. Joy was a pronounced advocate of this undertaking from the outset. He was urged to assume charge of the department of chemistry in the new school, but this he declined, and recommended that his assistant at Union, Prof. Charles F. Chandler, be called to organize the department. This advice was at once favorably acted on by the trustees of Columbia College, and Prof. Chandler was given the chair of Analytical and Applied Chemistry, with charge of the laboratories. Although his duties in the academic department were already quite onerous, Prof. Joy promptly volunteered his services as lecturer, and in the first catalogue of the School of Mines his name appears as in charge of organic chemistry. Later, when the regular faculty was organized, he was made Professor of General Chemistry, and so continued until his retirement in 1877; also in the meanwhile he remained at the head of the chemical department of the college proper.

The atmosphere of a large city is not conducive to much original work in science, and especially is this the case in New York city. Things of a more practical nature force themselves upon the attention of a scientist, and his opinion is in constant demand. In consequence, we find in the American Contributions to Chemistry but two papers devoted to original research contributed by Prof. Joy during the time of his connection with Columbia College. They are On Glucinum and its Compounds (1863), and Analysis of a Meteorite from Chili (1864), both of which were published in the American Journal of Science. Several of the analyses of minerals that appeared in Dana's System of Mineralogy by him were also made at this time. This meager record is readily explained by the fact that Prof. Joy's literary inclination was promptly taken advantage of by the editors of prominent periodicals, and articles from his skillful pen were constantly in demand. He was a frequent contributor to the Scientific American, and every week prepared columns of notes for Frank Leslie's periodicals, reviewing all of their foreign scientific exchanges for them. For many years he edited the Journal of Applied Chemistry, published in New York, and also wrote most of the articles on chemistry in Appletons' American Cyclopædia.

Prof. Joy was naturally prominent in numerous organizations, chiefly, however, in those of a scientific character. He held the chairmanship of the Polytechnic Association of the American Institute; he was also President of the American Photographic Society. During 1866–'67 he was President of the Lyceum of Natural History, now the Academy of Science, from which place he gracefully and generously retired after a brief service in order to afford an opportunity to Dr. John S. Newberry to be introduced to the scientific circles of the metropolis. In 1874, when the American chemists gathered at the grave of Priestley, in Northumberland, Pa., and an organization was effected to celebrate the Centennial of Chemistry, Prof. Joy was chosen one of the vice-presidents. He was a Fellow of the American Association for the Advancement of Science, and for a time was Foreign Secretary of the American Geographical Society; he was likewise an enthusiastic member of the Century Association. It is but fair also to record his active interest in various charitable societies, and he was a member of the Protestant Episcopal Church.

Among the many interesting experiences of his life none perhaps gave him more delight than his connections with the various World's Fairs. He served on juries of those held in London, Paris, Vienna, and Philadelphia. During the terrible heat in 1876, while actively engaged in his duties at the Centennial Fair in Philadelphia, he was prostrated by sunstroke. He was promptly brought to his city home, but a cruel illness of many

months followed, and at last, when he was able to again consider the resumption of his work, strength was lacking. In consideration of his years of faithful service, the college trustees retired him with a pension, and he returned to the scenes of his student days. For a time he was in Hanover, then in Switzerland, also in France, and in Munich. The World's Fair in Paris during 1889 attracted him there; but finally, after an absence of nearly ten years, he turned his steps homeward, and spent the winter of 1890–'91 at his own country home in Stockbridge, Mass. When the spring came he was already making plans to visit the great World's Fair, to be held in Chicago, but suddenly and with scarcely any warning a trifling indisposition seized him, and he died on May 29, 1891.

As has been shown, Prof. Joy filled many places of high honor with distinction. His associates and pupils held him in worthy esteem, and from the scientific world at large he deserves a more than passing notice, for it may be said it was his efforts that indirectly brought about that recognition of science in this city that culminated in the organization of the greatest School of Mines in the United States.

THE ice scenery of the mountains of New Zealand was first brought to notice by the Rev. W. S. Green in 1882, who that year explored the glacier region of Aorangi, or Mount Cook. Since then visitors have been attracted to the mountain region in increasing numbers; a hotel has been built in a convenient situation near the foot of one of the glaciers; surveys have been undertaken; and a series of exploratory expeditions has been begun by Mr. G. E. Mannering and his coadjutors. The southern Alps proper of New Zealand run from northeast to southwest for about a hundred miles, nearer to the western than to the eastern coast of the South Island. Hence the valleys fall more rapidly toward the west than toward the east; and on the latter side a wide tract of plain separates the sea from the foot of the hills. Being pierced more deeply by the lowlands, although the New Zealand peaks are considerably lower than those of the European Alps—the summit of Aorangi, the highest of them, being only 12,349 feet high—they tower as high and as steep above their actual bases. Aorangi, according to Mr. Mannering, rises "for nearly 10,000 feet from the Hooker Glacier, and Mount Seften 8,500 feet from the Mueller Glacier, while the western precipices of Mount Tasman (11,475 feet) are stupendous." The snow-line in these mountains lies much lower than in Switzerland, being only about 5,000 feet above the sea. Thus the glaciers are greater and descend lower than those of Switzerland. The Tasman glacier is eighteen or twenty miles long, and terminates at a height of 2,456 feet above the sea. On the western side the ice approaches occasionally to within 600 feet. Thus in the New Zealand Alps, says Mr. T. G. Bonney, reviewing Mr. Mannering's book in Nature, "the Alpine climber meets with the same difficulties and is surrounded by the same class of scenery as he finds in the Old World amid peaks and passes 3,000 feet higher." But, great as are these glaciers, Mr. Bonney adds, they are, like those of Europe, attenuated representatives of their predecessors, for New Zealand also has had its Ice age.

CORRESPONDENCE.

AN AUTHOR'S PROTEST.

Editor Popular Science Monthly:

MY attention has just been called to the notice you have given, in the May number of The Popular Science Monthly, of the second volume of the report upon which I am engaged (see pages 131 and 132 of the May number). I am gratified by the approval expressed of the "report proper," "five hundred pages of well-digested matter," etc., as that is in an especial sense my own work; but it seems to me the writer would have been more just if he had stated that the work was avowedly largely a work of reference, and also that every device had been availed of to facilitate such reference.

This book is made for the use of educators and teachers, and its purpose is to record what has already been done in this country in introducing "Manual Training in Public Schools," and *also* to furnish those considering the wisdom of making any changes in this direction, with the experience, opinions, and plans of educators who have seriously considered or undertaken the work. All the literature on these topics is ephemeral and not within reach of the ordinary teacher nor to be found in ordinary libraries. It largely consists of speeches, papers, addresses, and local reports. The movement is a live one, progressing by rapid strides, and the material grows rapidly. My purpose has been to get together and put in the hands of the teachers *all the material* and *the latest* material possible. Now, the work of planning, collating, preparing, arranging, *proof-reading*, and indexing this big book falls upon myself alone, with aid, part of the time, of a single copyist. As fast as the matter is proof-read it is stereotyped; so the only way in which I could add later matter was to turn the "Introduction" into an extra appendix. I know, as well as the wise reviewer, that if I could have had all the material in those appendices spread before me in clean printed pages as he finds it in this volume, I also could have made a smaller and a better-proportioned book; but my aim was to be of most use to the educators and teachers, and my reward has been, much as it may surprise our critical friend, to meet with the hearty approval of all classes of educators, including the Presidents of Yale, The Massachusetts Institute of Technology, Johns Hopkins, Tulane; the superintendents of education throughout the country, educational authorities like Newell and MacAlister, and countless teachers; while the National Education Association in convention at Saratoga last summer took occasion to pass a special resolution of approval.

Now to consider the special features criticised for a moment. The contemptuous treatment given to my first volume by The Popular Science Monthly, and especially by the New York Nation and the Evening Post, was such as to lead me to think that it might be well for me to put on record the approving judgment of such educational and literary authorities as the veteran educators Henry Barnard and George Bancroft, the poet Whittier for his appreciation of Philbrick, and John Sparkes, the head of the Kensington Art Schools. The press of the United States and also of Great Britain and France gave generous and intelligent approval of the first volume of this report; but in the Cosmos Club, of this city, of which I chance to be one of the founder members, The Popular Science Monthly, and the twin sheets over which Mr. Godkin presides, are largely read; and, of course, my standing, in the opinion of those who accept these as divine oracles, suffered! I proposed that this abuse—for the Nation-Post article was largely abuse—should be offset, so that in case any of the Cosmos followers of Godkin chanced to open my second volume, they might find that there *were other* views!

Your reviewer criticises the fact that the tributes were paid to Philbrick, Smith, and Perkins; but surely, if anywhere it was proper to have printed tributes to these three great teachers, it was in this report, the first volume of which was but a record of their great experiment, as this second volume is a history of what has been the immediate outcome of their endeavor. I should have felt condemned had I failed to pay such poor tribute to them as was in my power. Those three citizens did more for their country than hundreds of ordinary citizens are enabled to do.

One hundred pages of the "Introduction" it was plainly stated were made use of as an *extra* "appendix," since that part of the book is printed last; but your reviewer suppresses that fact, and implies that this "Introduction" is all a mere mass of useless verbiage.

It is the easiest of all things to sneer, as your reviewer has done; but is it very manly in a journal, professing to be respectable and scientific, to treat a serious work in such a flippant vein? If other books are reviewed with as little of the spirit of fairness, or with the effect of so plainly seeking to belittle them, as is shown by the treatment accorded to this volume, I shall hardly look to the Monthly as giving any very valuable information about the works it assumes to notice. I have thought it due to the work to write this much of protest against the attitude assumed toward it by the writer in the Monthly; but

yet it seems hardly worth while, for the verdict of approval by those for whom the report was undertaken had been given long before this notice appeared; indeed, the demand by teachers and educators for this "overgrown volume" and for its predecessor is so much greater than the supply that the closing reference to "so many copies going back unread to the paper vat" falls rather flat to those who know the facts; of course, however, the falsehood, which is there implied as a truth applicable to this particular publication, helps to damn book and author in the opinion of the ingenuous and gullible reader. I. EDWARDS CLARKE.

DEPARTMENT OF THE INTERIOR, BUREAU OF EDUCATION, WASHINGTON, *April* 29, 1893.

[We have never received a protest which furnished us quite so much evidence in support of our own position as does this letter of Mr. I. Edwards Clarke. In his first paragraph he shows that we discriminated between the well-digested part of his second volume and the gatherings of his drag-net. In his second paragraph he states that his purpose has been to get together "*all the material*" on his subject, which involved the reprinting of much "ephemeral" literature, such as "speeches, papers, addresses, and local reports." He does not show that the purposes of a "work of reference," as he calls his report, necessitate the reprinting of these speeches, etc., *in full*, nor does he seem to see that the reason why such compositions *are* ephemeral is that they are not sufficiently condensed to be suitable for permanent preservation. We are gratified to learn that our reviewers of Mr. Clarke's two volumes arrived independently at the same opinion of his work, for we find that the person who noticed the second volume did not know what another writer had said of the first in the Monthly seven years ago. We are also gratified to find ourselves in accord with such an able critical authority as The Nation. It is not surprising that a great many teachers and educators have wanted the book enough to ask for it. We stated in our notices that it contains much valuable material, and complained only of the quantity of chaff among the wheat. Mr. Clarke has evidently done his work conscientiously, but he needs the wholesome, bracing atmosphere which surrounds the writers of books that must pay their own expenses, and which the Government bookmaker is protected from. Finally, if any more evidence of his tendency to diffuseness were needed, it would be afforded by the length of the letter above.—EDITOR.]

THE TRACING OF THE PENNSYLVANIA GLACIAL MORAINE.

WE have received the following letter from Mrs. H. Carvill Lewis, in reference to some remarks recently made in The Popular Science Monthly concerning the work of the late Prof. Lewis and Prof. G. F. Wright in tracing the glacial moraine across Pennsylvania. Having given our authority in the editorial (Correspondence Department) in the April number for the statements made in the article Recent Glacial Discoveries in England, in the December number, we publish the letter without further comment:

HOTEL LANG, HEIDELBERG, *April* 16, 18 3.
Editor Popular Science Monthly.

DEAR SIR: In reference to your editorial on Recent Glacial Researches in England, Popular Science Monthly, March, 1893, and to my statement that "it was only over the *last third* of the work (i. e., in the tracing of the terminal moraine across Pennsylvania from June to October, 1881) that Prof. Carvill Lewis had the pleasure and benefit of Prof. Wright's companionship," may I take the liberty of calling your attention to the inclosed letters, which will explain themselves?

The question as to whether Prof. Wright has on one or more occasions seen the whole or "three fourths" of the moraine in Pennsylvania does not seem to me the point at issue. It is simply this:

Is the statement in Mr. Warren Upham's sketch of Prof. H. Carvill Lewis's life and work, as quoted by yourself, that in "the following year (1881) Profs. Lewis and Wright *together* traversed the southern border of the drift *from Belvidere on the Delaware*," etc., "*to the line dividing Pennsylvania and Ohio*," correct?

To this question an exact knowledge of the facts of the case compels me to answer "No," and in support of this opinion I inclose you two letters, the latter of which was published by Prof. Wright himself.

The matter itself is of little consequence, but as the accuracy of my statement is for the general reader of the Monthly apparently controverted by the abstract you have given from Mr. Upham's article, I feel it best to produce proof of its correctness.

With regard to the map of the glaciation of England, which prefaced your article in the December number of The Popular Science Monthly, I regret to say that it does *not* "represent Prof. Lewis's work as completed in England by Prof. Kendall." I most heartily wish that it did!

The map in question has in its main features been copied from some of the leading English authorities—*possibly* from one of the maps in Geikie's Great Ice Age, to which it bears a strong resemblance.

Over this older map, which is quite at variance with my husband's leading conclusions, the tracks followed by Scotch and Lake District erratics, as traced by Prof. Kendall, and the moraine line across England and Wales only, as traced by my husband, have been drawn. The moraine line is tolerably accurate.

The points of agreement between Prof. Kendall and my husband, and the proofs more recently found by Prof. Kendall in northwest England (a part of the country with which he is thoroughly familiar) of the correctness of my husband's views with regard to the origin of the interbedded marine and glacial deposits of Lancashire and Cheshire, will appear in full in the first appendix of the memoir on my husband's observations in Great Britain, which is now in the hands of the printer. I am, with respect,

Faithfully yours, JULIA F. LEWIS.

The following letter, inclosed in Mrs. Lewis's letter, was copied by her from the work on The Terminal Moraine in Pennsylvania, by H. Carvill Lewis, introduction, p. li.

(*Letter of Transmittal.*)

PROF. J. P. LESLEY, *State Geologist.*

DEAR SIR: In transmitting to you the following notes on the terminal moraine, I desire to express my thanks to the Second Geological Survey, which has afforded me the opportunity to undertake an exploration which to me has been of the greatest interest.

I desire also to express my thanks to those citizens and railroad companies which have rendered assistance in the prosecution of my field work. Especially I am indebted to my friend Prof. George Frederick Wright, of Oberlin, Ohio, who for six weeks—about one third of the time employed in field work in 1881—gave me valuable assistance.* While we were together over a great part of the field, portions of the moraine in central Lycoming and southern Venango Counties were traced by him alone, and his experience in the glacial phenomena of New England has been of great value in correlating similar deposits in Pennsylvania.

Hoping the inclosed report will meet with your approval,

I remain, very respectfully yours,

(Signed) H. CARVILL LEWIS.

GERMANTOWN, *October* 15, 1882.

The other letter referred to by Mrs. Lewis is a letter from her published by Prof. Wright, to whom it was written, in Science of May 27, 1892.

EDITOR'S TABLE.

THE ATTACK ON PROF. WRIGHT.

WE publish in this number an article by Major J. W. Powell, Director of the Geological Survey of the United States, in which much interesting information is given as to the problems, or some of them, which the Survey has taken in hand to solve, and as to the methods of investigation which have been employed. Major Powell's primary object is, however, to clear the Survey of the charge of having made a concerted and most bitter attack upon Prof. G. F. Wright's recently published book on Man and the Glacial Period, and in this respect we are compelled to say that we think his article a failure. We accept without the slightest reservation his disclaimer of any personal responsibility in the matter; but with the evidence before us we find it impossible to believe that a number of individuals, directly or indirectly connected with the Survey, did not, in a concerted manner, set themselves to attack Prof. Wright's book, and that in a spirit of personal hostility and spite far more than of zeal for scientific accuracy. Considering the nature of the language indulged in by Mr. W J McGee in regard not only to Prof. Wright's book, but to Prof. Wright himself, we think the director of the Survey might have spared a few words in which to express his personal disapprobation of it; but we look in vain in his article for anything of the kind. He admits that upon the publication of the work in question "his (Prof. Wright's) fellow-workers (on the survey) criticised the book in various scientific periodicals and sometimes spoke very disparagingly of it, as being unworthy of acceptance;" but he does not say that so prominent a member of the Survey as Mr. McGee penned and published an article

* I. e., in tracing the terminal moraine across Pennsylvania.—J. F. LEWIS.

breathing from the first page to the last the spirit of personal insult, and so far tried to set the key for the criticisms of other "fellow-workers." If the director had gone on and made this statement, which would have been quite relevant to the subject and purpose of his article, we think he would have felt it incumbent on him to express some opinion as to the expediency and propriety of his coadjutor's method of vindicating scientific orthodoxy as established at Washington. There is a manifest lesson to be learned from the incident. The Geological Survey is a body with wide ramifications, and whether it has already done so or not, it is in danger, from the very nature of its organization, of becoming a kind of scientific hierarchy, and, as such, of exercising an influence unfavorable rather than favorable to the increase of scientific knowledge. We learn from the director that when Prof. Wright proposed to publish his first book, The Ice Age in North America, Prof. Chamberlin, under whose direction he had worked as an assistant in the Survey, "demurred." It is really hard to see why Prof. Chamberlin should have taken upon himself to demur. Prof. Wright was not seeking to compromise any one but himself, and it was known that his work, of whatever character it might prove to be, would be fully open to criticism. If some scientific gentlemen could get it into their heads that science is not a personal matter, but a simple question of the establishment of general truths, and that every man is free to labor toward that end by the aid of such lights as he possesses, subject to correction by those whose lights are stronger and clearer, things would go more smoothly than they do in the scientific world, and the laity would not so often have to exclaim (with sarcasm), "See how these men of science love one another!" The services of Prof. Wright were dispensed with from the Survey—so the director tells us—because he failed to distinguish "overplacement" from original glacial deposit. We are not in a position to judge of the adequacy of the reason; but admitting that it was a sound one, might we suggest to the director that the writing of so discreditable an article as that which proceeded from the pen of Mr. W J McGee might perhaps be at least as serious a reason for removal from the Survey as even the non-recognition now and then of "overplacement"? As our readers are aware, the general soundness of Prof. Wright's observations was defended in a carefully written article by Prof. E. W. Claypole, which appeared in the April number of this magazine. It is not our part to enter into the controversy, but we can not help remarking upon the magisterial manner in which the Director of the Survey dismisses Prof. Claypole's article as being "based upon error in every paragraph." Let us hope that, if such is the case, some one will come forward and prove it otherwise than with a lofty wave of the hand.

A BACKWARD MOVEMENT.

We have often had occasion to notice the valiant struggles of our contemporary, The Nation, in the cause of rational journalism, and we earnestly trust it may not grow weary in well-doing, however potent the opposing forces may appear to be. We particularly wish it success—some measure of success, for there is no use in wishing too much—in its crusade against the fashion lately introduced by many of the daily papers of disfiguring their columns with woodcuts, far less for purposes of illustration in the true sense than as mere distractions for idle readers (save the mark!), who can not bear the stress of a score of lines of unbroken print. These cuts, the Nation says, with a measure of truth, are a natural sequence of the very childish editorial and news matter which many papers have for years past been serving up to the public. As our con-

temporary puts it, "The printed matter of some of them has for a good while been doing all that printed matter can to reduce the popular intelligence to that early stage which makes the life of nursery governesses and mistresses of kindergartens so hard, in which all the resources of pedagogy have to be exhausted to keep the child's attention fixed on anything." In a later article the Nation remarks that, for the purpose for which they are now employed, the "cuts" do not in the least need to be accurate. Their whole and sole purpose is to give a grown-up child something to look at, and whether or not they represent correctly the things or persons they are supposed to represent has simply "nothing to do with the case." The mind exhausted by the perusal of a dozen lines of letterpress finds refreshment and repose in gazing at a picture of any object, however common, connected in any way, however insignificant, with any incident, however trivial, that may form part of the gossip of the day. As the Nation sarcastically observes: "The great question of cabmen's beards might have been discussed indefinitely without the thorough elucidation given by a picture of a cabman with a beard, a cabman without a beard, and two or three cabmen prominent in the agitation."

Our contemporary fears that the end is not yet, that there is perhaps some lower depth of mental degradation to be sounded. A silly letter press prepared the way for yet sillier pictures, and the question now is what these are likely to bring forth as an ulterior result. If it is any comfort, we may reflect that the complaint of a growing childishness of the public mind is a somewhat ancient one. Without going further back, we recall Cowper's lines published in 1782:

"Habits of close attention, thinking heads,
Become more rare as dissipation spreads;
Till authors hear at length one general cry,
'Tickle and entertain us, or we die!'"

Nearly fifty years ago we find the poet Wordsworth inveighing against "illustrated books and newspapers" in a sonnet which, judging by later developments, does not appear to have had much effect, but which seems to express our contemporary's views exactly:

"Discourse was deemed Man's noblest attribute,
And written words the glory of his hand;
Then followed Printing, with enlarged command
For thought—dominion vast and absolute
For spreading truth, and making love expand.
Now prose and verse, sunk into disrepute,
Must lacquey a dumb Art that best can suit
The taste of this once intellectual land.
A backward movement surely we have here,
For manhood—back to childhood; for the age—
Back towards caverned life's first rude career.
Avaunt this vile abuse of pictured page!
Must eyes be all in all, the tongue and ear
Nothing? Heaven keep us from a lower stage!"

If the poet found so much to object to in the scanty attempts at so-called illustration made at the date at which this sonnet was penned (1846), what would he say to the present day development of the illustration business? He could have seen, had he lived to the present time, a picture, in a leading English paper, of the hide taken off the cow that ran down Mr. Gladstone; the cow itself was unfortunately killed and cut up before her likeness had been taken, but why that should have prevented the image of some other cow, of any cow, being offered to an intelligent public in her stead, or why the joints into which she was dissected should not have been severally photographed, and so exhibited as well as the hide, we have never quite understood.

It was a dictum of Auguste Comte, delivered about the time that Wordsworth was uttering his unavailing and, we must say, too undiscriminating protest against "illustrated books and newspapers," that the specific weakness of

the present age was a tendency to idiocy, which he defined as a condition in which mere sensations dominate and suppress mental activity; or, in other words, a life of excessive objectivity and defective subjectivity—insanity, according to him, being the exactly opposite condition. If The Nation is right in its diagnosis of present day tendencies, Comte was not very far wrong; and as that journal is certainly right in part, the question arises, What are we going to do about it? The first thing to do is clearly to recognize the nature and proportions of the evil. Illustrations in books and papers are useful when they either serve an æsthetic purpose or convey information of value which could not otherwise be as effectively conveyed. In scientific works they are, of course, indispensable. On the other hand, they do harm and not good when they minister to simple intellectual indolence, or help to gratify an aimless and idle curiosity. We are inclined to think that in children's books, even good illustrations (from an artistic point of view) may have the specific disadvantageous result of checking the exercise of imagination. The mind in childhood can make its own pictures, and will do so if nobody steps in with a picture ready made. With pictures illustrating every phase and turn of a story, there is little left for imagination to do and the faculty is apt to remain undeveloped for want of exercise. And an undeveloped imagination means an undeveloped, or at least ill-developed, individuality. There has been, we believe, a great deal of misunderstanding on this point in the past. It has been assumed that the more pictures children could be shown the more their minds would be stimulated; but, for the reason stated we believe this to be a great mistake. We can not further discuss the subject to-day, but it is manifestly one of much importance for old and young. Idiocy, or anything approaching to it, is not a condition of mind to be lightly cultivated.

THE "SAVAGERY" OF BELIEVING IN GHOSTS.

It is a good rule that a scientific writer, before castigating the expressions of another, should acquire a right comprehension of what is meant by them. The Popular Science News seems to have forgotten this rule. Referring to our article in the March number on The Everlasting Ghost, that periodical says that, just like "any superstitious savage," we had assumed that the appearances described by the Rev. Mr. Haweis as having developed themselves on certain photographic plates were "ghost photographs." If our contemporary had read the papers in the case more carefully—Mr. Haweis's article, for instance, or even only the heading of it, or had even read our article with closer attention to its bearing—it would have observed that the precise thing we were ridiculing was the assumption that the appearances on the plate were "ghost photographs," and would then have been able to direct its shafts toward the right quarter. We do not underrate the value of research in this domain, or in any part of the field of unexplained phenomena styled psychical; but we do condemn the spirit that enters upon the investigation occupied with the idea that a certain thing—as, for example, the ghosts in this case—is to be found. The savagery in the present instance, if there be any, appears to be illustrated in the uncontrolled impulsiveness that prompted an attack where there was no offense.

LITERARY NOTICES.

EDUCATION FROM A NATIONAL STANDPOINT. By ALFRED FOUILLÉE. International Education Series. Vol. XXIII. New York: D. Appleton & Co. Pp. 332. Price, $1.50.

VIVE la république!—the welfare of the nation—is the keynote of this book. Educators who would have a complete and well-balanced understanding of their own field should not omit to study the relation of edu-

cation to national interests. Dr. Harris has chosen an excellent tutor for them in M. Fouillée, an eminent scholar and one of the race in which the national spirit is notably strong. Assuming that each nation has a continuity of character, mind, habits, and aptitudes which forms an organic heredity and identity persisting from age to age, the author inquires how education can be made to assist in perfecting this national nature. After a word on the importance of physical education he states that the chief objects of intellectual education should be—first, the moral; second, the beautiful; and last, the true. The reader should be cautioned against accepting fully M. Fouillée's representation of the effects of the study of science. In various places, and especially in the chapters on the Scientific Humanities, he denounces the present teaching of science as if it actually represented this field of knowledge at its best, and declares that science has been weighed and found wanting. He ignores the fact that science has been taught often by unsympathetic teachers, without suitable materials, and for a very short period at all. In his chapters on the Classical Humanities he is much more sympathetic, recommending these subjects as the very best means of fostering a national spirit. He criticises severely what is known in France as a modern education, and proposes a reformed system of secondary training which should embrace these studies: 1, the literature of the mother country; 2, Latin literature; 3, general history; 4, the elements of mathematics and physics. Where diversity arises, it should be in only the following special subjects: Greek, secondary science subjects with applied science, and modern languages. In conclusion, he maintains that all education will prove defective from the national standpoint unless it includes moral and social science, and unless its several parts are unified by philosophy. Programmes illustrating the author's views are given in an appendix.

A CONTRIBUTION TO OUR KNOWLEDGE OF SEEDLINGS. By the Right Hon. Sir JOHN LUBBOCK, Bart. New York: D. Appleton & Co. In two volumes. Price, $10.

THE results of a wide-reaching botanical research are embodied in these two substantial and copiously illustrated volumes. The subject of this research is the forms of cotyledons, which not only differ greatly in different plants but are generally much different from the forms of the ordinary leaves in the same plant. Some cotyledons are broad, others narrow; those of the mustard are kidney-shaped, of the cress three-lobed, of the beech fan-shaped, of the sycamore shaped almost like a knife-blade, of Eschscholtzia divided like a hay-fork, of the bean or acorn thick and fleshy. The shape of the seed seems to have an influence on the shape of the cotyledons. Where the cotyledons are narrow and lie straight in a long, narrow seed, the relation is simple, but such cases are few. Often narrow cotyledons are found coiled in orbicular seeds. In many broad seeds we find two fleshy cotyledons laid face to face, and occupying almost the whole of the seed. In the nearly spherical radish seed the cotyledons are laid face to face and then folded along the middle. In other species one cotyledon is larger than the other, or the halves of each cotyledon are unequal; still other cotyledons are lobed, emarginate, auricled, etc., and for all of these features the author has found probable causes in the shape of the seed or the way in which the cotyledons are packed within it. A general statement of these points occupies the early part of the first volume, while the rest of the work is devoted to descriptions of the seedlings in a large number of genera. In procuring the seedlings for these descriptions the author has been permitted to make large use of the resources of Kew Gardens. A valuable feature of the work is the carefully drawn illustrations of seedlings, sections of seeds, etc., of which there are six hundred and eighty-four. An index and a bibliography are appended.

THE THEORY OF WAGES AND ITS APPLICATION. By HERBERT M. THOMPSON. London and New York: Macmillan & Co. Pp. 140. Price, $1.

THIS is a piece of close and clearly expressed reasoning upon one of the great problems of political economy. The author says that his economic statements are, for the most part, those accepted by the economists of to-day. These statements he sets forth in the first chapter, and upon them he bases the proposition that "the universal product

of industry and abstinence" (the "universal dividend," as it might be called) "is a mass of wealth varying in amount, and divided in varying proportions among the agents to its production." Holding this view, the author obviously can not accept the wage-fund theory nor the theory that labor is the residual claimant to the product of industry, nor the doctrine that "rent does not enter into the expenses of production," and his next three chapters are devoted to criticisms of these doctrines. In his criticism of the first-named theory he comes in conflict with Mill, Fawcett, and Cairns; he takes Walker as a representative of the second, and Marshall and Sorley as supporting the last. In his fifth and final chapter he applies his theory of wages to the eight-hour movement, trades-unionism, profit-sharing, etc.

How Nature cures, comprising a New System of Hygiene; also, The Natural Food of Man. By Emmet Densmore, M. D. London: Swan, Sonnenschein & Co. New York: Stillman & Co. Pp. 405.

In this work Dr. Densmore makes a bold effort to shatter all existing and accepted systems of dietary, and ominously warns his readers of the dangers of seeking the assistance of the medical profession in cases of sickness. The book is divided into three parts: How to Doctor, How to Get Well and Keep Well, and The Natural Food of Man. In the first chapter of Part I the author gives an example of the process of natural healing, or, as he terms it, "Nature's engineering." He says: "A sliver becomes imbedded in the flesh—a frequent accident. . . . If the sliver is permitted to remain, Nature at once sets about a bit of engineering. First, there is pain and inflammation; then follows a formation of pus; this in due time breaks down the tissues immediately surrounding the sliver, especially toward the surface of the limb; the pus increases, breaks through, runs out, and sooner or later carries the sliver with it." And he claims that "these and like processes of Nature are all the healing force there is."

Further on, he asserts that the deaths of both George Washington and President Garfield were either hastened or directly caused by the drugs of the physicians in the first instance, and in the second by the daily probing for the bullet, which, if left undisturbed, would not have been fatal. All through the early part of the work the author advances argument after argument against the uses of drugs for healing purposes, and in the fifth chapter he makes the announcement that, although surgery can be classed as a science, "medicine is not a science; it is empiricism founded on a network of blunders."

The second part of the book treats of How to Get Well and Keep Well, and embraces a series of chapters upon the uses and abuses of certain foods and their relative values for promoting health. In the first chapter of this part, while admitting that "bread, cereals, pulses, and vegetables are the bases of the food of civilization," he denies the urgency of their forming the bases of food, and in fact distinctly states that these and all other starch foods are not beneficial to the system; and he urges the use of ripe sweet fruits in their place. This contention he bases upon the fact that starchy foods such as bread, cereals, etc., are not digested in the first stomach, but have to pass into the intestines, which they overtax during the process of digestion.

Considerable space is devoted to arguments against the use of tea, coffee, tobacco, and alcoholic beverages; and the author scathingly attacks the use, or rather the abuse of the use of opium by "orthodox physicians." In the third part are repeated his ideas upon the curative powers of Nature, and the evils of using starchy foods. In this part, also, he attacks the accepted theory that varying the diet is beneficial to the digestive organs, and advises a similar meal of meat and fruit every day. The book concludes with a number of "Conformatory Chapters," in which Dr. Densmore seeks to defend his theories.

Speeches of Sir Henry Maine. With a Memoir of his Life, by the Right Hon. Sir M. E. Grant Duff. New York: Henry Holt & Co. Pp. 451. Price, $3.50.

The man who is here portrayed in his public utterances and official writings was one of the leading lights of the century in the field of jurisprudence. In 1847, at the early age of twenty-five, he was made Regius Professor of Civil Law at Trinity College, Cambridge. Three years after he betook himself

to legal practice in London, which, together with lecturing and literary work, occupied his energies for twelve years. In 1861 he published his Ancient Law, which at once became an authority and a text-book. The following year he accepted the Law Membership in the Council of the Governor-General of India. He held this position until 1869, and during this period two hundred and nine acts were passed. The speeches and minutes that make up the body of the present volume relate to matters of East Indian legislation which demanded his attention during these years. Some of these matters concern the government of provinces—i. e., Judicial Taxation, The Bengal Legislature, and Over-Legislation; others, such as Divorce, Emigration, and Whipping, concern the daily life of the people. In all may be seen Maine's breadth of view and his temperate and convincing style of argument. Besides their biographical interest these documents have also a sociological value from the glimpses they give into the life and thought of the East Indian peoples. Sir Grant Duff's memoir tells much about Maine's university days, his writing for the Saturday Review and other journals, and recounts, also, the appointments and honors of his later life.

In Volume III of the *Journal of American Ethnology and Archæology*, *A. E. Bandelier* gives a most interesting outline of the documentary history of the Zuñi tribe, which will serve as an important link in the chain of evidences of prehistoric civilization on the northern portion of this continent.

At no time in our history has there been such an influx of speculative literature concerning prehistoric man in America as is now offered to ethnological students; considerable discussion existing as to the conditions of prehistoric man, his period of advent here, and probable characteristics and civilization. From among the many works upon this interesting subject it is still difficult to accept as satisfactory and conclusive evidence the consequential conclusions of the writers. Their researches are of decided speculative value to science; but they advance their theories and make their conclusions solely upon the vague probabilities of certain conditions and appearances of archæological discoveries.

The material used in this monograph is exclusively derived from Spanish documents, which the author was enabled to study in the archives of the Mexican Republic, and of the Indies, at Seville, Spain, and chiefly concerns the discoveries of certain Spanish monks between 1538 A. D. and the end of the seventeenth century. From these documents it is evident that a high degree of civilization existed among the Zuñi people early in the fifteenth century, and must have existed there for hundreds of years prior to the discovery of the country by the Spaniards. Here is an extract concerning the expedition of Fray Marcos, of Nissa, in 1538: "... About a month and a half ago there came a monk, lately arriving from some newly discovered land which, they say, is five hundred leagues from Mexico, ... and toward the north. Of this country it is said that it is rich in gold and other valuable products, and has large villages. The houses are of stone and earth, the people use weights and measures, they are civilized, marry only once, dress in woolen goods, and ride on certain unknown animals." Another witness testifies that "there were many cities and towns well peopled; that the cities were walled and the gates guarded; that the people were very wealthy; that there were silversmiths; that the women wore jewels of gold, and the men girdles of gold and white woolen dresses; that they had sheep, cows, and quails, and that there were butchers and smithies." It is therefore evident that the Zuñi Indians possessed a civilization long prior to the advent of European explorers; and as the authenticity of these documents is unquestioned, we have, in the researches of Mr. Bandelier, some very important matter upon which to build further and reliable inquiry into the prehistoric conditions of man on this continent. Unfortunately, the almost total destruction of the archives in New Mexico by the Indians, in 1680, renders it difficult to secure a complete history of the past of New Mexico, and of the discoveries in Arizona which were made by explorers from New Spain in the early part of the sixteenth century. Nevertheless, in this monograph considerable light is thrown upon the conditions, civilization, and characteristics of the early dwellers of North America.

In a report on the *Relations of Soil to*

Climate, by *E. W. Hilgard*, Professor of Agricultural Chemistry in the University of California, which was published by authority of the Secretary of Agriculture, there are a great many suggestions concerning the effects of temperature and climate upon undeveloped soil and upon its physical character. It does not enter into the remedial possibilities of the question; but at the very opening of the paper Prof. Hilgard makes the interesting and valuable statement that "since soils are the residual product of the action of meteorological agencies upon rocks, it is obvious that there must exist a more or less intimate relation between the soils of a region and the climatic conditions that prevail." From this standpoint he discusses the effect of the phenomena.

At the Marine Biological Laboratory, Woods Holl, Mass., according to the *Fifth Annual Report*, some important biological discoveries have been made; among them, for the first time in history, the embryological "feat of tracing the annelid larvæ through every stage of development *cell by cell*." The report explains the purpose and work of the laboratory, and gives schedules of the different courses of instruction, investigation, etc. Several memoirs on amphibian development are in progress by the members of the laboratory, one of which is completed. It covers the whole period of development up to the establishment of the fundamental features of the embryo, including the formation of the egg and the phenomena of fecundation. Director Whitman closes his report with an appeal to American lovers of science to assist the managers of the laboratory by providing funds to enable them to extend their space and operations in giving instruction in marine biology.

In a paper entitled *Twenty Years of Progress in the Manufacture of Iron and Steel in the United States*, *James M. Swank* makes an interesting examination of these industries. He gives some statistical comparisons between the productions of Great Britain and the United States, which point to the fact that this country has not only passed her great rival in the production of pig iron, but also in that of steel. In the manufacture of Bessemer steel, ingots, and rails the United States has more than doubled the production of Great Britain, while the latter country still holds first place in the manufacture of open-hearth steel. His account of the change from iron to steel in the manufacture of rails is interesting, and shows that iron rails *practically* ceased to be manufactured in 1892. In a paragraph on the United States tin-plate industry he says, "The new tin-plate industry has made remarkable progress since the new duty went into effect;" and this he illustrates by some statistics of its growth. In the summary of his statistical statements Mr. Swank shows that the United States is now the first of all iron and steel manufacturing countries. The paper is an extract from the *Mineral Resources of the United States*, and is published by the Department of the Interior—United States Geological Survey.

Horace V. Winchell, State Geologist of Minnesota, makes a valuable report on the *Iron Ores of the Mesabi Range* of Lake Superior. He claims that the iron mines of this district are the richest "known in the world to-day," and he gives some interesting statistics of the output and probabilities of the Mesabi iron range since its discovery in 1890. The report embraces a history of the mining of the district, a list and approximation of the outputs of the mines now opened up, tables of analyses of the Lake Superior ores, and comparisons with those of other States and of Europe. The information concerning the methods of prospecting, sampling, testing, transportation, etc., in use at this range will be read with interest.

Mr. *William Bowker* contributes a very useful paper on the relation of fisheries to agriculture. It is entitled *The Harvest of the Sea*, and was read by him at the winter meeting of the Massachusetts Board of Agriculture. He makes a strong argument in favor of utilizing the non-edible and unwholesome fishes that abound in our waters —as well as fish refuse—for agricultural purposes. He gives some interesting extracts from the "*History of Plimoth Plantation*," showing that as early as 1621 the Indians were aware of the value of fish as a fertilizer, and he calls attention to the remarkable fact that the word *menhaden* was applied to the fish of that name by the Indians because it means "fertilizer, that which manures." Mr. *Bowker* pooh-poohs the idea that the supply of fish can be measurably

diminished, no matter what methods man may use for their capture; and he suggests the establishment of experiment stations for developing fish and other plant-food industries. (Boston: Wright & Potter, 1892.)

In pamphlets 202 and 203 of the United States Fish Commission *Bashford Dean* contributes some important data concerning the science of oyster culture. The first of these reports deals with the *Physical and Biological Characteristics of the Natural Oyster Grounds of South Carolina.* He draws attention to the appearance of immense natural but partly obsolete oyster beds on the coast of this State, and explains how oyster culture might be again profitably developed there. In the chapter on the Absence of Oyster Spat in Deep Water, Mr. Dean calls attention to the extraordinary silt suspension along the coast, and points out that this matter is, *de facto*, one of the causes why oysters do not thrive in the deeper waters. He claims that "to plant in deep waters clean shells as spat collectors would in this region be futile"; but that an abundance of both oyster seed and oyster food exist in South Carolinian waters, and that in the marginal waters, "from the level of low tide to about a fathom in depth," oyster culture could be very advantageously developed.

The second pamphlet is entitled *A Report on the Present Methods of Oyster Culture in France.* This subject is very interestingly discussed, and the result of Mr. Dean's observations will, by comparison, be of pertinent value to those who are interested in the conditions, industry, and culture of the oyster in American waters. He tells the entire process of oyster-raising in France, from the time the swimming fry becomes attached to the collectors until the grown oyster is shipped for consumption. He also defines the difference between the American oyster and the French "flat" oyster, which is akin to the English "native." The American and Portuguese are monosexual, whereas the "flats" are bisexual; so that, as says Mr. Dean, it is difficult to reconcile the relationship between both species. Both reports are profusely illustrated with photographs of the localities and processes of collection and general culture. (Washington, 1892.)

Edwin T. Dumble, State Geologist of Texas, in a report of 243 pages, gives an exhaustive treatise on the "character, formation, occurrence, and fuel uses" of the brown coal and lignite of his State. These coals are widely distributed throughout Texas, the coal measures of the "northern central portion of the State" occupying an area of several thousand square miles. Recapitulating the results of his investigations—some of which were made in Europe, for the purpose of comparison—Mr. Dumble claims that "brown coal and lignite, of good quality and under certain conditions, are fully capable of replacing bituminous coal for any and all household, industrial, and metallurgical purposes."

There are instructive chapters on artificial fuel, the composition of Texan coal, and its utilization and formation. And the State Geologist adds that as Texas has an abundant supply of brown coal "equal to the best which has been utilized, and far superior to much that has been used satisfactorily in other countries," there is no economic reason why the wonderful coal measures of Texas should not be more fully developed. (Austin: Ben Jones & Co., 1892.)

Barton W. Everman, Assistant Commissioner of Fish and Fisheries, has made interesting reports on the advisability of establishing fish-hatching stations in the Rocky Mountain region and Gulf States. In making such an investigation several considerations have to be taken into account. The chief requirement is a constant supply of *pure* water, "not less than a thousand gallons per minute," at a temperature not exceeding 50°; but of equal importance is the selection of a stream or spring free from contamination and containing as few as possible of such enemies of the *Salmonidæ* family and their spawn as the blob, etc. The first part of the report is devoted to his investigations in Montana and Wyoming. In some of the mountain streams no trout were found, and in many of those streams there was a marked absence of algæ, chara, and other suitable water vegetation. All the tributaries of the Columbia and Missouri Rivers were investigated—fifty-nine streams in all—and finally Dr. Everman considered that the most advantageous places to select as a hatchery are Horsethief Springs, Botteler Springs, and Davies Springs. All of these are close to Yellowstone National Park, in Montana, but he prefers Horsethief

Springs, which flows into the Madison River. He says that this stream "most nearly fills all the natural requirements." It abounds in suitable water vegetation, as well as in small mollusks and insect larvæ; it is already used as a natural hatchery and spawning ground by trout, whitefish, and grayling; the water never freezes, and, says the assistant commissioner, in making his recommendation, "they are among the most remarkable springs that are to be found in the United States." In the second part of the book Dr. Everman gives a report on his investigations made in Texas for a similar purpose. During this investigation thirty new species of fish were discovered, descriptions of which are given. Many excellent locations for a fresh-water station were found in the interior, but Dr. Everman says that "no point on the coast offers entirely satisfactory conditions for the establishment of a combined fresh and salt water station; but the Swan Lake site, near Galveston, might prove fairly suitable." The reports are illustrated with photographs of the localities investigated and of the fishes inhabiting each locality.

Coals and Cokes in West Virginia is the title of a pamphlet compiled by *William Seymour Edwards*, which gives, "in a handy form," a more precise knowledge of the coal measures and industry of West Virginia. It consists of a general review of the coal fields, and a series of chapters on their geological, stratigraphical, chemical, and physical condition. The greater portion of the work is devoted to tables of the chemical and physical analyses of the coals and cokes of the State "in comparison with those of other States in America and Europe."

Third Annual Report of the Geological Survey of Texas. E. T. Dumble, F. G. S. A., State Geologist. Austin: Henry Hutchings, 1892. Pp. 410, with maps and illustrations. This report embraces not only the geological and mineralogical conditions of Texas, but also gives some interesting historical facts connected with the development of the State. Accompanying the report are papers on geological investigations in Houston County, by W. Kennedy; Section from Terrell to Sabine Pass; Llano Estacado, or Staked Plains, by W. F. Cummins, notes on the geology of the country west of the plains; Stratigraphy of the Triassic Formation in Northwest Texas, by N. F. Drake; and several other reports dealing with the paleontology of the vertebrata and the cretaceous area, and Trans-Pecos, Texas. A considerable portion of the mineralogical part of the report is devoted to Prof. Dumble's investigations of the coal measures of the State; and in the chapter on Agriculture he explodes the idea that the Staked Plains was a wide expanse of desert sand. They were marked so on all "the old maps as the Great American Desert"; but the State Geologist says, "This has been proved to be utterly untrue, for there are no spots on this wide expanse upon which there was not formerly a luxuriant growth of natural grasses."

In Brochure I of Volume II of the *Proceedings of the Rochester Academy of Science*, Mr. *John Walton* contributes a paper on the Mollusca of Monroe County. He gives some useful advice to collectors of mollusca, and illustrates his paper with one hundred and thirty-five cuts of as many different varieties and species. Mr. Charles S. Prosser's paper on The Thickness of the Devonian and Silurian Rocks of Western New York, approximately along the Line of the Genesee River, minutely analyses the stratification of the Genesee section. The brochure also contains an article on the Guelph Formation in Rochester, and an interesting synopsis of the proceedings of the botanical section of the academy. (Edited by P. Max Foshay, secretary, Rochester, N. Y., 1892.)

The seventeenth year book of *New York State Reformatory at Elmira*, January, 1893, is a very exhaustive report of the condition, financial, educational, industrial, etc., of the institution. It was entirely produced by the inmates engaged on the institutional journal, The Summary, and is from the Reformatory press. It is beautifully printed on supercalendered paper and is profusely illustrated. The report of the general superintendent contains a plea for the establishment of "well organized and managed reformatory prisons," and he draws attention to the fact that most of the criminals are the product of "civilization" and "emigration to our shores from the degenerated populations of crowded European marts." In that portion of the book entitled Results there is a very interesting examination into the causes of criminality of certain prisoners, their prog-

ress during imprisonment, and their conditions, socially and industrially, after liberation.

In a volume of 194 pages Mr. *Nathan Cree* contributes a useful argument for *Direct Legislation by the People*, which is the title of his work. He does not claim that such a form of government would be a "remedy for all the political ills of society," but he points to many errors in the existing systems, and argues that at least an epoch of direct legislation would tend to better and more economic government. He says that "popular power in this country stands in no need of a vindication, either of its rightfulness or practicability," but he adds that the "power-holders do not govern directly, although elected by a widely extended suffrage." The author charges that the electoral bodies, which are the ultimate power in the United States, "delegate their powers to agents," and he seeks to prove that a modification of the present system combined with the primitive direct government would not alone be better and more interesting, but that the adoption of it is within the natural order of modern political evolution. (A. C. McClurg & Co., Chicago. Price, 75 cents.)

Bulletin No. 7 (Part I) *of the Geological and Natural History Survey, Minnesota, N. H. Winchell*, State Geologist, consists of a descriptive and popular account of the features and habits of the *Mammals of Minnesota*, by *C. L. Herrick*. In consequence of the delay in the publication of the reports, which were handed over in 1885, this portion of the work contains only the descriptive and popular portion of the survey. The scientific part, which embraces the materials collected on the anatomy, especially the myology and osteology of the Minnesota mammals, will form the second part. Part I is clearly written, and will be welcomed by all lovers of natural history. It is illustrated with twenty-three figures and seven plates, and is published by Harrison & Smith, State Printers, Minneapolis.

In a volume of 128 pages, *Elizabeth E. Evans* offers to the public a peculiar theological discussion, which she describes as "a condensed statement of the results of scientific research and philosophical critcism, as applied to the history of religion." In her argument the authoress assails every Christian belief, and in the preface she declares that "all creeds are alike false." She scoffs at the idea of a Trinity as accepted by all Christians; says that Jesus was a myth or simply a pure man and a fanatic; and that "the idea of a God originated from the fears of man in the presence of the natural forces which he is unable to control." She seems to lean toward the doctrine of metempsychosis; and, while scoring the Roman Catholics and Protestants, pays tribute to the purity of intention of the Buddhist faith. (New York: Commonwealth Company.)

J. E. Usher, M. D., has given to the world an interesting and useful treatise on *Alcoholism and its Treatment*. Comparing the disease with insanity, he says that although the latter is a deplorable thing in any form, "no phase of mental breakdown is more far-reaching in its influence" than alcoholism. Tracing the disease through its "inherited" and "acquired" forms, he brings his reader to the fourth chapter, which is entitled Insanity and Alcoholism. Here, in four pages, he lays bare, with admirable skill, the awful resultant danger to chronic drunkards from the condition of insanity into which their over-indulgence has plunged or may at any moment plunge them.

The chapters on Alcoholic Trance and Crime and Cerebral Automatism or Trance are the most interesting parts of the work. They are devoted to the examinations of cases of murder, forgery, manslaughter, robbery, etc., committed while the automatic action of the brain continues from the action of alcohol. The last two chapters are devoted to the best means of treating those suffering from alcoholism, embracing a number of useful prescriptions as well as a ringing denunciation of all patent nostrums sold for this purpose. (New York: G. P. Putnam's Sons, 1892. Pp. 151. Price, $1.25.)

In a book of 184 pages, Mr. *Arthur Willink*, in order that a more easily comprehensive idea of God—whom he designates the Unseen—may be attained, says that his object is to submit as a proposition that "it is in higher space that we are to look for the understanding of the unseen." He carries us by a rather difficult but ingenious road through what he supposes to be the first, second, and third directions or dimensions of space to the "fourth dimension" or "high-

er space"; and here is where he locates the presence of God and also that of the departed souls. This invention he apologizes for by saying that it is "a terribly hard thing to realize." Nevertheless he assumes its existence and the conditions referred to for the purpose of penetrating, without irreverence, into the secrets of the unseen, for he says: "Seeking for the truth there is neither presumption nor irreverence, nor intrusion into forbidden ground, always provided that the search is prosecuted in a right spirit." Notwithstanding the ultra-scientific style of Mr. Willink in this work, and although it will not be understood by many, there can be no doubt but that his motive is excellent, and that the book will be read with pleasure by many of those interested in the higher theological subjects. (*The World of the Unseen.* New York: Macmillan & Co. Price, $1.25.)

In issuing a second edition of his work on the *Geographical Distribution of Disease in Great Britain*, Dr. *Alfred Haviland* has divided it, making Part I, now published, cover Cumberland, Westmoreland, and the Lake District (Macmillan, $4.50). In this part the geology and physical geography of the region are fully described, and the distribution of different diseases is set forth. There are several colored maps showing geological formations, contours, and the distribution of phthisis, cancer, and heart disease. In this edition the statistics of deaths from 1861 to 1870 are added to those from 1851 to 1860, used in the first edition. An appendix contains a list of plants growing in limestone districts, tables of population, etc.

In *The Dynamic Theory of Life and Mind* an attempt is made by *James B. Alexander*, of Minneapolis, "to show that all organic beings are both constructed and operated by the dynamic agencies of their respective environments." The author has gathered into his thousand octavo pages a great number of accepted facts in biology, paleontology, physiology, acoustics, optics, electricity, and psychology. Scattered through this mass of material is a limited amount of argument in support of his contention that "organisms, instead of being hand-made and purposive, are machine-built machines, and operated when built by forces outside of themselves." That is to say, that organs are shaped by the influence of functions upon parts not yet adapted to those functions, and that the activity of the organism is determined by stimuli from without. The data are drawn from competent sources, and all the author's statements are made in a clear and temperate style. Over four hundred figures illustrate the text.

The Geological Survey has issued a monograph on the *Geology of the Eureka District, Nevada*, by *Arnold Hague*, with an atlas. The area covered by the survey here recorded is about twenty miles square, and lies in the central part of Nevada. The monograph is a quarto volume of four hundred and nineteen pages, embracing a general description and a geological sketch of the district, with discussions of the rocks of the several epochs that are represented within the area in question, and an account of the ore-deposits found there. A Systematic List of Fossils, by C. D. Walcott, and a paper on the Microscopical Petrography of the Eruptive Rocks, by J. P. Iddings, are appended. Eight plates illustrate the text. The atlas contains eleven folio sheets, one covering the whole district, and the others representing the several divisions of it on a larger scale.

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POPULAR MISCELLANY.

Copper in the United States.—Each of the main geographical subdivisions of the United States, according to Mr. James Douglas, possesses a distinct group of copper deposits. The Appalachian chain of mountains carries throughout its entire extent, from far beyond the northern limits of the United States to near the Gulf of Mexico, copper, which is chiefly but not exclusively contained in masses of iron pyrites imbedded in crystalline slates. Copper mines were worked before the Revolution in Connecticut, New Jersey, and Pennsylvania. More recently mines have been worked in nearly all the Eastern, Middle, and Southern States from Maine to Alabama, but most extensively in Vermont and Tennessee. From the great trough between the Appalachian and Rocky Mountain chains, drained by the Great Lakes and the Mississippi, but little copper has been extracted except from the State of Michigan. There have been small workings in other places, but not important. The copper-bearing beds of the Keweenaw series in Michigan, extending, but not in profitable veins, into Wisconsin and Minnesota, consist of beds of trap, sandstone, and conglomerate of doubtful age. Everywhere in Michigan the copper of this series exists exclusively in the metallic state. Three classes of deposits are worked in the Keweenaw promontory: the veins that yielded those extraordinary masses, stray blocks of which were reverenced by the Indians, which attracted the attention of the Jesuit fathers, and which have appealed to the popular fancy; copper beds of amygdaloid diabase, locally called *ash beds*, and amygdaloid traps; and beds of conglomerate, of which the cementing material consists in part of copper. There are sulphureted ores of copper in Michigan and Wisconsin outside of the Keweenaw series, but mines of notable productiveness have not been opened on any of them. The Rocky Mountain mines may be subdivided into two groups—those of southern Arizona and those of northern Montana. With insignificant exceptions, all Arizona copper comes from three groups of deposits: those near Clifton, at Bisbee, and near Globe. The ores heretofore yielded by these mines have been naturally oxidized, and with the elimination of the sulphur have been purified from certain other obnoxious elements which are commonly associated with sulphur. The Butte mines in Montana came into productive existence almost simultaneously with the mines of Arizona; but, instead of maintaining an almost stationary production, their record has shown an extraordinary augmentation of yield from year to year. Outside of Butte, no district promises in the near future to be largely productive. Promising indications of copper wealth exist in the Seven Devils' district in Idaho, but they have not been exploited. Nevada, Utah, and Wyoming have all yielded more or less copper, and all contain ores which under more favorable circumstances than now exist will be utilized. Colorado stands in the list as a producing State of growing importance. New Mexico does not produce much. On the Pacific coast, California alone has been notable in production.

Coal-tar Perfumes.—The revolution which chemistry has brought about in the manufacture of colors is now becoming apparent in the perfumery industry. As vegetable colors are being gradually replaced by the colors derived from coal tar, so artificial perfumes are gradually taking the place of the natural ones; and these derivatives from coal tar promise to give the best results in the future. Artificial perfumes are obtained by means of the ethers, liquids remarkable for their characteristic odors; by suitably composed mixtures by which imitations are obtained of the perfumes of fruits and of the principal alcoholic drinks; and

fixed formulas are given for each flavor and for each liquor. These artificial perfumes are much used for the preparation of confections into the composition of which neither fruit nor sugar enters, but only algæ, potato glucose, and artificial flavors, and of bonbons, jellies, liquors, etc. The essences of cognac and rum are also much used in the preparation of drinks with alcohols of grain, sugar beet, or potato. The perfumes of flowers are harder to imitate. Recourse was at first had to mixtures of other cheaper or more easily obtainable natural perfumes. An advance has now been made, and chemistry has succeeded in imitating these odors with substances derived from plants by complex reactions. The first perfume derived from combinations with the derivatives of coal tar was nitrobenzine, which was obtained by Mitscherlich in 1834, but is manufactured on a large scale only by Collas, in Paris, under the name of essence of mirbane. It has an odor like that of bitter almonds, and is used for perfuming soaps. Perfumes of similar origin have multiplied very much in recent years; and we now have among them artificial wintergreen, artificial musk, etc.

Floral Festivals.—In the arrangement in the Arsenal Garden, Tokio, Japan, of special collections of plants selected for the purpose of producing a display of flowers at different seasons of the year, Garden and Forest perceives an idea which can perhaps be adopted advantageously in other parts of the world. It is the expression, it says, of the love of the Japanese for particular flowers and of the popularity of the flower festivals held in spring, when the apricot trees and the cherry trees bloom; in summer, when the wistaria, the irises, and the morning-glories are in flower; and in the autumn, at the season of the chrysanthemum, and when the leaves of the maple trees assume their brilliant coloring. Every public garden in Japan contains collections of these plants, at least of the apricots, the cherries, and the maples, and they are visited by the greatest number of people when these plants are in flower. Their flowering is the excuse for parties of pleasure, and the intelligence of millions of people has in this way been quickened by their interest in the unfolding of petals of cherry trees or wistaria. Similar arrangements might be made in our own parks. "As our cities grow large and absorb the surrounding country, many of their inhabitants must pass their lives in ignorance of some of the most beautiful things in Nature, without beholding, for example, the glory of an apple tree in flower. In some corner of any one of our large parks, or better, in different parks of a series or system, a number of permanent outdoor flower shows might be arranged which would add immensely to their value as places of resort, and would have a powerful influence in directing and educating the public taste. There are many trees, for example, with showy and beautiful flowers, which display their greatest beauty only when massed together in considerable numbers; and if the people of our cities had the opportunity to see such collections, they would very soon make holidays for the purpose, and flower festivals before many years would become as much a part of our life in cities as they have in Japan."

Superstitions concerning the "Black Devil."—While the Dara Deil (*Forficula oleus*), or "black devil," a kind of earwig, used to be an object of almost universal abhorrence in the folk lore of Ireland. Its services were sometimes invoked in labor that demanded extraordinary physical exertion. In creeping along, whenever it hears any noise it halts, cocks up its tail, and jerks out its sting, which is similar to that of a bee. No reptile has been so much feared and dreaded by the peasantry as this insect, and it used to be commonly believed that it betrayed to his Jewish enemies the way the Saviour went when leaving the city of Jerusalem. It was no small gain to destroy this insect, for seven sins, it was said, were taken off the soul of the slayer. The people believed that the sting of the Dara Deil was very poisonous, if not mortal, and that it possessed a demoniac spirit. Under this impression, whenever it was seen in a house by the peasantry they always destroyed it by placing a coal of fire over it, and when it was burned the ashes were carefully swept out. It was not trodden on by foot, as a less formidable insect would be, nor was it killed by a stick, for it was believed that the poisonous or demoniac essence would be conveyed to the body of the slayer through leather or

wood. It has often been related that laborers have been enabled to perform extraordinary feats through the agency of the black devil, which they inserted in some part of their implements of labor; but the few who were so daring as to have recourse to such means were regarded as dabblers in the black art, and were looked upon as reckless, as "utterly left to themselves," and almost beyond the pale of salvation. This insect is still considered extremely dangerous; it is thought to be a kind of scorpion; but very few, indeed, are now disposed to lift it to the dignity of preternatural influence.

Growth of Willow Trees.—Garden and Forest has received a photograph of a willow tree standing in Waterbury Centre, Vt., the trunk of which measures twenty-four and a half feet in circumference, and whose symmetrical top shades an eighth of an acre of ground. A person who knows the early history of the willow testifies that in 1840 it was a tree about six inches in diameter, which had grown from a walking-stick driven into the ground a few years before by some children. In that year it was cut down deep into the ground in the hope of killing it, but it started a new growth, and has reached its present dimensions in fifty years. The rapid growth of the willow in favorable localities is well known, and Dr. Hoskins (from whom the photograph was received) writes of another near his home, which sprang from a cane carried by a returning soldier in 1866, and thrust into the soil in his dooryard. It is now more than four feet in diameter, with an immense top, and bids fair, at an equal age, to reach the dimensions of the one spoken of.

The Jagir Duseens of North Borneo.—The Governor of British North Borneo, visiting the island of Banguey, found there a tribe of Duseens, differing in language, religion, and customs from other tribes bearing that name. Among one of these people, called Jagir, spirits are believed in, and also the power of a priestess to keep them in order; "for she is acquainted with their ways, and knows the future as well as the past." She nominates and trains her successors, but they must wear black robes and carry wooden knives. The priestess thanks the chief spirit, on behalf of the tribe, at the harvest festival when the paddy crop has been successful; but the people never appeal to the spirits or practice any religious ceremony in connection with births, deaths, sickness, or marriages. Marriages are performed, without public gathering or feast, in the forest in the presence of the two families. The rite consists in transferring a drop of blood from a small incision made with a wooden knife in the calf of the man's leg to a similar cut in the woman's leg. After marriage the man takes the bride to her home, where he resides in future as a member of the family. These people have long hair, secured with a wooden pin at the back of the head, and cut short on the forehead. Their only covering consists of a scanty fragment of bark. They use for fire-making both flints and a pointed friction-stick, which differs slightly from the one generally used in the archipelago. The tribesmen are honest, trustworthy, and industrious.

A Chinese Naval College.—The Imperial Naval College at Nankin, China, according to Dr. Fryer's report, was opened about two years ago for the purpose of educating young men of talent for official positions in the southern fleet of the Chinese navy, the northern fleet having been already provided for. It has now eighty students between seventeen and twenty-five years of age, about equally divided between the branches of navigation and engineering. Two English teachers are engaged, with several Chinese teachers who have been graduated from the Tientsin Naval College and are employed as instructors in drilling, rifle practice, torpedo work, and other branches. The second classes of both the navigation and the engineering branches are also taught by qualified natives. The Chinese studies are directed by literary graduates, who teach the classics and other subjects of the usual course. With the good beginning it has had, and ample room for expansion, there can be little doubt, says the report, that the college, under its present administration, will eventually grow into a permanent institution that will bear comparison with some of those of foreign countries. The Chinese mind seems to be able to undergo a severe amount of study and discipline that is simply astonishing. Handicapped by having to keep up

their own classics and literary style, while all they learn of foreign subjects is through the medium of a new and difficult language, these youths must be made of the finest material to make any progress at all. The learning capacity and memory of a good Chinese student are almost beyond credibility. It is only in the invention or originating of new ideas or in making deductions that they are weak. Those subjects which depend chiefly on the use of mathematics have received the most particular care and attention.

Sound Economics.—Judging from the summary in the London Spectator, some sound economics are embodied in the utterances in a recent speech by Mr. Balfour touching upon questions of labor and social relations. The speaker animadverted on the unhappy consequences that might ensue from admitting that every one who wants work has a right to get it from the municipality or the state if he can not find a private employer. The admission of such a principle means municipal or state bankruptcy as the not distant consequence of works begun only in order to find employment for the unemployed without any guarantee that they will pay those who set them on foot. When private employment becomes hard to obtain, it is generally because the conditions of the time are unfavorable for effective labor. Now, if just at this crisis the public employer comes in, does it not mean that either the municipality or the state will pay as much for ineffective and ill-supervised labor as private employers have been paying for effective and well-supervised labor? That is only saying, in other words, that they will be paying high for bad labor. Mr. Balfour also gave a warning against attempting so to improve the distribution of wealth as to prevent its production where it is now successfully accumulated. The worst of the new combinations against the present rate of wages is that the rate of profits, already low, must fall lower if higher wages are to be paid, and the consequence of that must be the retirement of a good deal of capital from productive enterprises altogether. The rich manufacturers say to themselves: "We are as rich now as we really care to be. We would go on if we could secure our former profits; but as we can not, we may as well wind up business and retire." The consequence, of course, is that a great deal of wealth which was lately employed in reproductive operations is no longer so employed, and the raising of the general rate of wages becomes more and more impossible.

Solid Air.—At the meeting of the Royal Society, March 9th, Prof. Dewar communicated the results of his experiments upon air at very low temperatures. Having liquefied air at ordinary atmospheric pressure, the author has since succeeded in freezing it into a clear, transparent solid. The precise nature of this solid is at present doubtful, and it can be settled only by further research. It may be a jelly of solid nitrogen containing liquid oxygen, much as calves'-foot jelly contains water diffused in solid gelatin. Or it may be a true ice of liquid air in which both oxygen and nitrogen exist in the solid form. The doubt arises from the fact that Prof. Dewar has not yet been able by his utmost efforts to solidify pure oxygen, which, unlike other gases, resists the cold produced by its own evaporation under the air-pump. Nitrogen, on the other hand, can be frozen with comparative ease. It has already been proved that in the evaporation of liquid air nitrogen boils off first. Consequently the liquid is continually becoming richer in that constituent which has hitherto resisted solidification. It thus becomes a question whether the cold produced is sufficiently great to solidify oxygen, or whether its mixture with nitrogen raises its freezing point, or whether it is not really frozen at all, but merely entangled among the particles of solid nitrogen, like the rose-water in cold cream.

Psychology of some Words.—In his essay on The Language of the Mississaga Indians of Skūgog (a tribe remnant of less than fifty members living on Skugog Lake, opposite Port Perry, Ontario), Mr. A. F. Chamberlain touches upon some questions connected with what may be called the psychology of language. Only a few of the words appear to have an onomatopoetic origin. Neither the theory of Dr. Carl Abel of the designation by primitive man of the "A" and the "not A" by the same word—no trace of this combinatory process being perceived—nor that of

Wundt, that words referring to things or actions in the immediate surrounding of the speaker were shorter than those relating to more distant objects or actions, is confirmed. A few specimen words of various classes are given to illustrate the peculiar nature of some of the names: The word for the proper name of man signifies "chief bird"; that for woman, "sun in center of sky"; those for rainbow, "he covers the rain"; for milky way, "the sturgeon stirs up the lake of heaven with his nose and makes the water roily"; eclipse is "dead sun"; moon, "night sun"; spring (the season) is "good water"; Sunday, "worship day"; the toes are "they run in rotation"; corn is "grain of mysterious origin"; cranberry, "marsh fruit"; hammer, "the striker"; shot, "little duck ball"; horse, "it has one hoof"; cat, "little glutton"; blanket, "white skin"; and shirt, "thin skin." The method of procedure in forming words by combination varies from simple juxtaposition of words to complicated agglutination or word decapitation. The language has a large number of radical suffixes and affixes, or words that have no independent existence as words, but take the place of real words in composition. Some of the animal myths and beast fables of the tribe quoted by Mr. Chamberlain remind us of Uncle Remus.

Origin of Fashions.—The question of the origin of fashions has been much discussed of late, without any fully satisfactory answer having been found for it. Perhaps as nearly correct a theory as any is that of the London Spectator, which believes that there is no ruling mind in the matter, "no system of deliberate invention or choice at all. The leading dressmakers of London and Paris find their advantage in varying their designs as frequently as possible; and wherever a novelty achieves any success, whether it be in London or in Paris, it is immediate copied by other dressmakers, and its general adoption is as rapid as that of a slang word. Equally rapid is its course toward exaggeration; its salient features are further and further enlarged until the exaggeration becomes grotesque, the reaction sets in, and fashion swings back to the other extreme. Take, for example, those peculiar sleeves which are now worn. They began quite modestly in the shape of a little puff upon the shoulder; these excrescences grew and grew until they developed into the enormous and unsightly humps which almost eclipse the wearer's head when viewed from one side. The next stage will be the gradual retreat back from this monstrosity to the perfectly plain sleeve. The plain sleeve will begin to pall again; some one will invent a swelling at the elbow, and a swollen elbow will become fashionable, until exaggeration has caused it to swell beyond all bounds, and then back it will go to its primitive simplicity, until the whole operation begins again *da capo*. The whole working of fashion may be divided into three separate processes—genuine improvements with an idea either to beauty or comfort, which happen to hit the popular taste; exaggeration of these improvements; reaction from the exaggeration. That, at least, is how it appears to us. As to the originators of the improvements, we believe that they may be counted by hundreds."

Excessive Schooling.—The status and prospects of education were recently discussed by Lord Justice Bowen, of England, in an address at the London Workingmen's College. The speaker's view is described as one of "subdued hope." While education has within our day undergone changes that are hardly less than revolutionary, he admits that they have not been wholly for good. "The stream of knowledge has spread far and wide beyond its accustomed banks; it does not flow everywhere at its old depth. The first result of the flood is to fill the land with what seems to be a mighty river; the next is to hide to all but practiced eyes the course of the true stream. There is a wide expanse of waters, but they are almost everywhere shallow and very often muddy." Our modern education has been too largely vulgarized. The quality of the supply is inevitably affected by the quantity of the demand. The half-trained multitude can not distinguish between the best and the second best; and prolific mediocrity is at a premium. Yet we must not be too sadly disappointed that our overwrought expectations have not been wholly fulfilled. The more prudent advocates of popular education never pretended to present it as a cure-all. They never thought that it was designed to supersede morality and religion. They never expected

that it would at once remove all social distinctions or polish intellectual pewter into sterling silver. They have confined themselves to a modest trust that it may do something. It has done something already, and they humbly believe it will do more. Time is needed to measure the consequences of so great a social change. The new leaven has been spread among large classes of the nation hardly touched by it until yesterday. As one great benefit it has rendered the competitive system possible in the public service, and has saved the country from the evils of nepotism, and from the worse evils of a political scramble for the spoils. But competition is not a good thing in itself—only a "sad necessity." "The cultivation for market purposes of brute brain power" may, indeed, have its uses. It probably saves a large number of fairly able men from their innate inclination to sheer idleness, and it probably provides the public services with a regular supply of fairly competent recruits. But it can never, except by accident, breed a competent scholar. Its direct tendency is to divert the thoughts of those engaged in it from all that the real lover of learning and literature seeks with a constant love. But even the diffusion of "mediocre culture" gives the average masses a better chance of fulfilling their vocation than did the reign of general ignorance that prevailed among them not many years ago.

Paradoxes of Animal Courage.—Having mentioned a supposed hostility of wild dogs against tigers, a writer in the London Spectator goes on to remark that the fierceness of the wild dogs' attack seems to have affected the tiger—a clever and "reflecting" animal—with a kind of nervousness which extends to all dogs; and enforces his remark with the story of a tiger which ran away from the bark and spring of a domestic spaniel. "It is, of course, just possible that the tiger was 'nervous,' and that the little dog merely exhibited the impudence habitual to little dogs who know that they can worry a horse or a bullock into beating a retreat when quietly lying down in a field. Extreme nervousness is often the accompaniment of great courage in certain animals, especially of the larger kinds. Indian rhinoceroses, kept by a rajah for fighting in the arena, where they could exhibit the most obstinate courage in combats with elephant or buffalo, would tremble and lie down at the unusual sight of a horse outside their pen; and the elephant is more liable to sudden panics and alarms than any other animal. It is strange to think of the same animal advancing boldly to face a wounded tiger and receiving its charge upon its tusks, and running away in uncontrollable panic from a piece of newspaper blown across the road. It is said that the scent or roar of a bear in the jungle will often scare elephants beyond control; and they have the same intense nervousness shown by the horse at the sight of things unusual or out of place. A big elephant which was employed to drag away the carcass of a dead bullock, and had allowed the burden to be attached by ropes without observing what it was, happened to look round, and instantly bolted, its fright increasing every moment as the unknown object jumped and bumped at its heels. After running some miles, like a dog with a tin can tied to its tail, the elephant stopped and allowed itself to be turned round, and drew the bullock back again without protest. Yet an elephant, *with a good mahout*, gives, perhaps, the best instance of disciplined courage—courage, that is, which persists, in the face of knowledge and disinclination—to be seen in the animal world."

A Whipping Game.—The whipping game of the Arawacks of British Guiana, as described by Mr. E. F. Im Thurn, is played by any number of persons, but generally only by men and boys, for one, two, or three days and nights—as long, that is, as the supply of *paiwari*, the native beer, holds out. The players, with but brief intervals, range themselves in two lines opposite each other. Every now and then a pair of players, one from each line, separate from the rest. One of these puts forward his leg and stands firm; the other carefully measures the most effective distance with a powerful and special whip with which each player is provided, and then lashes with all his force the calf of the other. The crack is like a pistol shot, and the result is a gash across the skin of the patient's calf. Sometimes a second similar blow is given and borne. Next the position of the pair of players is reversed, and the flogged man flogs the other. Then the pair retire, drink good-tem-

peredly together, and rejoin the line, to let another pair take their turn of activity, but presently, and again and again at intervals, to repeat their own performance. It has been said that the most active players of this extraordinary game are the men and boys. But occasionally the women take a part also. And it is noteworthy that when this is the case a wooden figure of a bird, a heron, is substituted for each of the whips, and a gentle peck with this bird is substituted for the far more serious lash of the whip. "I do not know," says Mr. Im Thurn, "that any equivalent example of the fact that the germ of the idea of courtesy to the weaker sex exists among people even in this stage of civilization is on record."

Cleansing Function of the Hair.—Dr. Henry Sewell calls attention, in Science, to an example of the subservience of form to function afforded by the arrangement of the epidermic scales constituting the outermost layer of animal hairs. The buried edges of the scales point toward the root of the hair, while the free edges project obliquely toward the tip; and a hair glides between the thumb and finger far more easily when pulled from root to tip than when pulled in the opposite direction. When rolled between the fingers it will gradually move parallel to its length in the direction of the root. It follows that foreign particles may be easily moved outward toward the tip of the hair and away from the body, while it would be hard to push them in the opposite direction. Every movement of the hair, especially frictional disturbance, must set up a current of foreign particles toward the hair tip. The value of this property as a cleansing factor is evident.

Telephotography. — Telephotography is the name of an art the purpose of which is the production of photographs of objects at considerable distances from the operator, of such quality and scale that they can be examined and interpreted in a manner that would be impossible to the naked eye. The term is parallel in meaning with telescopy, and the art has as its aim the recording on a photographic plate of a combination of a number of distinct and separate telescopic impressions that can be obtained by sweeping a telescope over a greater field than that included in its own field of view, in the same manner, but to a less degree, that ordinary photographs record a number of distinct and separate visual images or impressions obtained by passing the eyes rapidly and almost unconsciously through the "wide" and "deep" fields of view, as they are termed. The apparatus consists of a combination of the telescope and photographic apparatus, with special supplementary lenses for magnifying the image and obtaining a flat field, the descriptions of which, by Thomas R. Dallmeyer, the inventor, are too technical for available use here. By it magnified and clearly depicted views are obtained of objects that are situated at such distances from the photographer that ordinary photographic means have hitherto rendered so small and insignificant as to be useless—views that are superior beyond comparison to enlargements of ordinary negatives.

NOTES.

JAPANESE jugglers have exhibited a trick which consists in throwing knives at a person extended against a structure of boards, into which the knives appear to stick alarmingly close to the subject. The trick has been copied or imitated by European prestidigitateurs; but instead of real knife throwing and sticking, an illusion is arranged. Knives are hidden in recesses in the board structure, skillfully concealed by shutters, which open by a spring controlled by the target-subject. When a knife is thrown he moves one of these springs, and causes the hidden knife to emerge and appear as if stuck in the board, while the shutters instantly close; or the same is effected by means of wires controlled by persons behind the scene. The operator who throws the knife either casts it skillfully behind himself, among the scene-slides, or else throws it so that it shall strike, not into the boards, but on one side, where it falls noiselessly upon the carpet. The latter method is the best, because it enables the spectator to see the knife pass across the stage.

A FULL account of the Polynesian canoe is in preparation by Dr. N. B. Emerson, of Honolulu. The author points out in an article on the subject that the various migrations of the ancient Polynesians and their progenitors, from whatever sources derived, must have been accomplished in canoes or other craft, and that the *waa*, the *pahi*, etc., of to-day, however modified they may be under the operation of modern arts and appliances,

are the lineal descendants of the seagoing craft in which the early ancestors of the Polynesians made their voyages generations ago. He holds, therefore, that a comparative study of the canoes can not fail to shed light on the problems of Polynesian migrations and relationships.

THE presidents of sections of the British Association for its meeting at Nottingham in September are: Section A, Prof. R. B. Clifton; Section B, Prof. Emerson Reynolds; Section C, Mr. J. H. Teal; Section D, Canon Tristram; Section E, Mr. Henry Seebohm; Section F, Prof. J. S. Nicholson; Section G, Mr. Jeremiah Head; Section H, Dr. Robert Munro.

THE summer course in botany of the Torrey Botanical Club and the College of Pharmacy of the City of New York includes an annual course of ten lectures delivered between the last of April and July 1st, with ten conducted excursions—having the nature of extended out-of-door lectures—into the woods and fields. The course is provided as a means of instruction for business and professional men and women desiring to become practically acquainted with the chief principles of the science and with the local flora, but who have not the ordinary means of study provided by the schools and colleges.

A MEMORIAL volume is announced to be published by Wilhelm Engelmann, Leipsic, in honor of the seventieth birthday of Rudolf Leuckhart. It will include numerous contributions in the lines of their work by grateful pupils of Leuckhart, and will be illustrated by a portrait in heliogravure, forty plates, and forty-three figures in the text. In the list of contributors we observe the English names of Charles W. Stiles, C. L. Herrick, G. Herbert Fowler, Edward Laurens Mark, and C. O. Whitman, editor of the American Journal of Morphology.

A DISCOVERY made by Mrs. Zelia Nuttall and a reconstruction of the calendar system of the ancient Mexicans are described in the Report of the Peabody Museum of American Archæology and Ethnology as showing from astronomical data that the Mexican calendar has an antiquity of at least four thousand years.

AN interesting testimonial was recently presented by Italian men of science to Prof. Maurice Schiff, of Geneva, on the occasion of his seventieth birthday. Prof. Schiff was from 1863 to 1876 Professor of Comparative Physiology in the Istituto dei Studi Superiori in Florence, where he introduced valuable improvements in teaching. He retired from that chair in consequence of the agitation excited against him by the anti-vivisectionists. He went to the school at Geneva, where he has acquired great fame and popularity. During his career he has enriched medical literature with many valuable contributions. The testimonial to him is an illuminated text on parchment, conveying the esteem and admiration in which his character and career are held, composed in Latin by Prof. Cavazza, and signed by an imposing number of surgeons, physicians, and medical teachers.

INVESTIGATIONS of the fermentation of tobacco by Suchsland have resulted in the discovery of different kinds of micro-organisms as active agents in the operation in the several varieties. Pure cultures of bacteria obtained from one kind of tobacco and inoculated upon another kind generated in the latter a taste and aroma resembling those of the tobacco from which they were taken. The discovery is greatly calculated to simplify the imitation of the finer varieties of tobacco.

AN immunity against cholera is claimed for habitual users of vinegar, which is attributed by Mr. Hashimodo to the acetic acid contained in the best vinegar—a substance deadly to the comma bacillus. These bacilli were killed in fifteen minutes in an experiment in which they were treated with a vinegar containing only from three to four per cent of acetic acid.

THE latest application of aluminum is to visiting cards, which are described as being thin, flexible, brilliant with a metallic luster, light, and admitting an impression of the names as distinct as it is made on paper. They can be made at a cost of about a dollar a hundred.

THE results of experiments by Prof. Marshall Ward tend to prove that the action of sunlight is a far more powerful agent in the purification of the atmosphere than has hitherto been recognized. The author has discovered, for instance, that the anthrax bacillus, while it will withstand the greatest extremes of temperature, is killed by direct sunlight. Water is also thus purified.

OBITUARY NOTES.

LUDWIG LINDENSCHMIT, a distinguished German archæologist, who died at Mainz, February 14th, in his eighty-fourth year, was director and one of the founders of the Central Romano German Museum of Mainz; one of the editors of the Archiv für Anthropologie; and author of works on German archæology. He began a general handbook on the subject, but completed only the volume relating to the Merovingian period. He was an advocate of the theory that the Aryan race is of European origin.

M. ALPHONSE LOUIS PIERRE PYRAMUS DE CANDOLLE, the famous botanist, died in Geneva, Switzerland, April 9th. He was born in Paris in 1806, but spent most of his life in Geneva, where he became famous as an author and authority in his special branch.